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One night in Christmas week, an unknown schooner, during a gale, cut through the destroyer "Warrington," severing forty feet of her stern.

HOW A SCHOONER SHEARED A DESTROYER.—[See page 65.]

SCIENTIFIC AMERICAN

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs re *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Lessons of the Equitable Building Fire

TO emphasize obvious lessons in regard to the fire dangers attending the commercial centers of a great city there was hardly required such a catastrophe as the recent burning of the antiquated headquarters of the Equitable Life Assurance Society. That a building of far more modern design and construction, filled with office furniture, books, records, and other inflammable material, could be all but totally destroyed, has long been known. Nevertheless, the fire, attended as it was by the temporary dislocation of business for the financial interests of the metropolis and the more permanent complications resulting from the loss of valuable legal and other documents, brings once more before our commercial communities the fearful price they are destined to pay for permitting buildings far from fireproof in business districts.

On the other hand, it is a cause of congratulation that notwithstanding freezing weather, a fierce gale and all conditions favorable to the spread of a conflagration, an efficient fire department was able to prevent wholesale destruction of life and property. Handicapped as it was by zero temperature and the too tardy receipt of the first alarm, the record of the New York Fire Department at this great fire is one worthy of the highest commendation. Not only was the Equitable Building itself far removed from modern standards of fireproof construction as largely typified in its neighbors (in fact, economic conditions were calling for its early demolition), but it was located without the present limits of the high pressure fire service zone, rendering necessary the use of steam fire engines.

With the high pressure system there would have been instantly available enough water under pressure sufficient to send it to the top of the Equitable Building, and the spectacle of fire engines being frozen fast in the ice would have been missing. Furthermore, were such high pressure hydrants connected with the standpipes of the building, not to mention those of adjacent structures, sufficient water would have been available in the interior from shorter lines of hose more rapidly stretched in. If, as may be a feature of future high pressure working, mains or hydrants were permanently connected with building standpipes by valves at the curb or sidewalk under control of the firemen, valuable time might be gained in bringing to bear the resources of the city fire department. Yet under existing conditions a large fire confined to the building of its origin and restricted to a single block is an accomplishment of no mean merit and one rather reassuring to the occupants of New York skyscrapers to whom the possibilities of a "conflagration in the air" have been presented.

But it is not so much by city fire departments that lessons are to be learned. It must be remembered that "fireproof" is a relative rather than an absolute term, and a building so designated when filled with inflammable material becomes combustible. Granting that the Equitable Building was of obsolete or "sub-standard" construction, and that any inquiry into its construction would involve past rather than present conditions, the conclusion is inevitable that when a fire once gets beyond control the same general results will follow even in many "fireproof" buildings similarly utilized and maintained. Of course the best construction must be demanded and obtained, but more than this a due regard for the dangers of fire must be observed even in buildings of the best type. The responsibility must be shouldered by owners and tenants and satisfactory conditions maintained by municipal inspection and regulation. Every building over six stories in height must supply its own fire protection, and by its system of maintenance no less than by its construction and equipment it should be impossible for any chance fire ever to reach serious dimensions. By metal sash and window casings and wire glass it should be protected from the exposure hazard caused by adjacent buildings, which is the case with skyscrapers in the neighborhood of the Equitable. Although safety devices and automatic alarms may be installed, a fire can soon develop to serious dimensions if there are at hand but a watchman or two and a few ignorant employees unskilled in using the building hose and extinguishers. The most perfectly constructed fireproof skyscrapers in New York are the best equipped for fighting fires, not only within their own walls, but in adjoining buildings, as was shown at the Equitable fire by the use of fire streams from the Hanover Bank and other buildings. While a complete auxiliary fire-fighting equipment and a well-drilled force is essential, it does not mean that the alarm to the city department should be delayed an instant, for at best the heavier pressures and hose lines can be used only by trained firemen, and the loss of valuable time may be vital. That too much stress cannot be laid on the advantage of equipping a building with various protective devices it is only necessary to recall the experience of the non-fireproof building of the California Electric Company at the time of the San Francisco fire. Notwithstanding a hot fire which destroyed every adjacent structure, this building was saved, simply because it was well supplied with standpipes and attached hose used by intelligent employees and fed from a well, pump and tank in the basement as well as from a roof tank.

It may be said that the problems of fireproof construction and fire protection and prevention are now well understood. Wonderful progress has been made on the technical side, and even in the highest buildings reasonable safety to life and property can be guaranteed if plainly indicated precautions are taken in construction and maintenance. In short the question has passed from engineering and technology to economics and municipal interest and administration. The sins of omission and commission in American building of the past may require a long and expensive period of expiation, but they are no excuse for improper construction in the future. Architects, engineers, insurance men and public spirited citizens are uniting to formulate good codes. Their enactment and enforcement in the interest of the whole public rather than of special interests and politicians lie with the people, and it is to their awakened consciousness that we must look for the removal of a national reproach which such incidents as the Equitable fire accentuate.

The New York Automobile Shows

DURING the past fortnight there have been no less than four automobile shows in New York city. Preceded by a show of foreign cars at the Hotel Astor, the twelfth annual show opened in Madison Square Garden. This show, which is the last that will ever be held in the Garden owing to the tearing down of this historic building next month, extended over two weeks, from the 6th to the 20th, and was in two parts. Last week was given up to pleasure vehicles, while during the present week commercial cars have been on exhibition.

Exquisite bodies and self-starting and silent motors were the most noticeable features of the pleasure vehicle show this year in the Garden. Runabouts and touring cars were invariably fitted with fore doors, as began to be the case last year. This year, however, there were many excellent closed cars, both inside-operated coupés or Berlines, as well as roomy limousines. In many of the latter type on exhibition the front seats were as completely inclosed as were the rear ones. A large electric inside-operated brougham upholstered with light tapestry attracted particular attention.

The coupé was the principal type of body displayed on the electric vehicles. Chief of these was a roomy, low-hung Berline with wide facing seats over the batteries, so that there were no unsightly battery boxes on the outside of the body. The motor was mounted in an inclined position above the rear axle, and drove the differential at the center through a worm gear. The efficiency of this form of drive was shown by a rear axle exhibited in motion, driven by an electric fan mounted in place of the motor. A blast of air from a larger fan placed a few feet away rotated the idle fan which, through the worm gear, turned the axle. Lead "Exide" batteries were used on most of the electrics, but Edison cells could be substituted if preferred for from $200 to $600 extra. The lead batteries have a guaranteed life of 20,000 miles without cleaning or renewals, whereas the Edison nickel-iron cells are guaranteed for five years irrespective of mileage. Edison cells were shown being raised and dropped three-quarters of an inch while in use. A vehicle cell is said to have been tested in this manner and dropped a full inch 2,000,000 times without shaking any noticeable amount of active material out of the grids. With one or two exceptions, all the electrics were shaft-driven, with the motor at right angles to the rear axle.

There were no chain-driven cars of any kind at the show, with the exception of a single low-priced runabout and a friction-drive machine. Shaft drive is now practically universal.

Magneto ignition has nearly as much vogue as shaft drive. It is employed on probably 98 per cent of the cars. A few still use one of the several single-spark battery systems employing dry batteries on a source of current.

As for motors, the Knight type of sliding sleeve engine has been adopted by several of our leading manufacturers now that it has been tried and proven for several years abroad. Sectional models of the Knight motor and the regular poppet-valve engines were shown on the various stands. There were few, if any, novelties in motors. A single exception (described on page 72) was exhibited in the basement. This had a split ring that was moved up and down about an inch near the top of the cylinder above the piston, and that covered or uncovered ports in the cylinder walls. This invention of the French pioneer Renault may possibly displace the sliding-sleeve type of motor, as the latter has the poppet-valve type. The Knight motor is still a novelty in America. In the European shows of late many new types of rotary-valve motors and the like have been shown. These are the result of the Knight motor, which set all the foreign inventors working.

The two-cycle motor does not seem to have increased in use, and beyond the three or four standard marks, none was on exhibition. In the Grand Central Palace show three different firms exhibited air-cooled two-cycle motors upon commercial vehicles. Two of these were of the 3-cylinder vertical type, with a 4-inch cylinder having cast flanges, while the third had flanges built up of applied copper forks wired to 3½-inch cylinders. A novel delivery tri-car designed by H. P. Maxim was exhibited at the Palace show. A 2-cylinder, air-cooled, four-cycle motor was mounted above the front wheel, which it drove by a chain through a new type of friction clutch running in oil. On top of each exhaust-valve chamber was a vertical tube about 18 inches in length by 1¼ inch in diameter. These tubes were half filled with water while the air was partially exhausted, the idea being that the exhaust valves will be kept cool in this way without a water-cooled head, pump, etc. Both the main and auxiliary exhausts were connected to a muffler built along the lines of Maxim's gun silencer. At the Garden show but one air-cooled make of car was exhibited. This is the product of a pioneer American manufacturer who still sticks to the air-cooled motor and shows it in a 6-cylinder, four-cycle model of 4 inch bore. Nearly all builders of high-priced cars show 6-cylinder models this year. The engines of some of these are comparable to motor boat engines in size, the cars being veritable road locomotives.

An excellent display of motor bicycles was a feature of the Garden show. While these were not fitted with self-starters like many of the automobiles, they nevertheless had clutches, starting cranks, and two-speed gears, and were thoroughly up-to-date. Single, two, and four-cylinder models were shown. There are said to be 75,000 of these "poor men's automobiles" in use in the United States.

The self-starting systems shown consisted of electric (ignition dynamo geared to the flywheel), compressed air, and acetylene gas. The last is very neat and simple, using the compressed gas from the tank carried to supply the headlights. These self-starters make the gasoline car as practical for a lady to drive as is an electric.

Electricity

Miniature Ball-lightning.—A phenomenon in the shape of a traveling globular spark was noticed by Leduc in 1899, and more recently Dr. Morin made some observations upon it in Europe. To produce it, two needles are put down on a photographic plate and connected with a static machine. A globule starts from the negative needle and moves slowly along the gelatine to the other pole. Its path is shown by the decomposition of the silver salt and the burning of the gelatine. Dr. Morin now uses a stronger machine, and finds that the globules now make up a continuous stream and also take a number of branching paths. He works in the dark and then develops the plate so as to obtain curious ramified phenomena. Much depends on the kind of photographic plate that is used. Such globule streams are not affected by the magnetic field. The action seems to take place only in a discontinuous medium such as is given by a photographic emulsion, with its particles surrounded by the non-conducting gelatine.

Novel Spark Producer for Wireless Apparatus.—A new wireless method employed by M. Paul Jegon in France may prove of considerable practical interest as it is claimed that a wireless station can be made to work much more safely than before by its use. The method depends on the use of a new spark producer which avoids the formation of an arc and thus has an advantage over the usual kinds. M. Jegon discovered that when two spark balls were placed at the greatest sparking distance, and then one ball was surrounded by a circle of wire connected to it, the sparking distance could be doubled and the spheres thus separated considerably. This property is not true for an electric arc, so that an arc cannot jump at this distance and the formation of an arc is thus avoided. The wire takes the shape of a ring and surrounds the sphere without touching it, the face of the ring lying perpendicular to the gap. An electrical connection must be made between the ring and the sphere, however. Where a cylinder is used, the wire then takes the shape of a rectangle. The method is very good for use with musical sparks.

Wireless Around the World.—In our issue of December 23rd, 1911, we referred to the plans of the French Government for a chain of wireless stations in French colonies by which messages can be sent around the world. Other countries are engaged upon similar projects for their colonies, especially Great Britain. The route chosen will take in Gibraltar, Malta and Alexandria in the Mediterranean region, then Aden, Bombay, Colombo, and Singapore in the Indian Ocean region. From here the messages will reach Australia and will then be sent by different posts to Montreal and Glace Bay, crossing the Atlantic to Cliffden. There will be branches from this general course so as to reach the Cape and other parts of the African coast, and also China, by way of Singapore, with one post located at Hong Kong. Germany is also at work upon an enterprise for connecting Berlin with the African colonies and the Pacific possessions. Messages will be sent across Africa from the east to the west coast. Italy also proposes to make connection with Africa, with one station at Pisa and others at Massaouh and Tripoli.

German Experiments in Electroculture.—Some interesting experiments in electroculture, which were conducted at Dahlem, Germany, during 1909, have been described in a recent official report published in Berlin. A certain number of plants, including spinach, radish, cabbage and lettuce, were adopted as standards, for the purpose of comparison. These were not artificially electrified, but on the other hand were not shielded in any way from the normal electricity of the atmosphere, which is found to be an important factor in plant growth. The growth of these "control" plants was rated as 100 per cent. Another group of similar plants was exposed to intensified atmospheric electricity by means of currents on an overhead wire. These showed an increase of yield amounting to from 15 to 40 per cent. A third group was treated with artificial high-tension electricity (direct-current). With a strong current the yield varied between 90 and 105 per cent, i. e., it averaged below the normal. With a weak current it was from 100 to 125 per cent, i. e., on an average, considerably above normal. In a fourth group, comprising only dwarf French beans, the plants were covered with a wire cage, arranged to exclude the natural electricity of the atmosphere. These showed a yield of only 86.5 per cent, i. e., they were decidedly below normal. It is found that applications of electricity should not be made during hot sunshine. In summer, early morning and evening are best; in spring and autumn 7:30 to 9:30 A. M., and for two hours before dusk; in winter only in the morning, from 9:30 to 11:30. Applications during rain are useless, but, on the other hand, foggy weather is most favorable. Unmistakable success has, according to the report in question, been achieved in hastening the ripening of strawberries by several days, thus enabling the growers to command the highest prices at the beginning of the season.

Science

The American Association for the Advancement of Science will hold its next meeting at Cleveland, beginning December 30th, 1912. The general committee has recommended that the meeting in 1913 be held at Atlanta, and that a summer meeting be held on the Pacific coast in 1915. Prof. Edward C. Pickering, director of Harvard College Observatory, has been elected president for the current year.

Color Photography on Paper—Dr. J. H. Smith is said to have invented a photographic printing paper capable of reproducing photographs in natural colors from suitable negatives. We must frankly confess that we do not as yet understand the principle involved. We are informed that the paper is printed in the sun for about two hours (longer in the shade) in the usual manner, until it acquires the colors of the plate. The colors are assumed without the application of any solutions or developing agents. When the print corresponds with the original hue it is taken out of the frame and fixed to render the dyes more permanent, and then mounted as an ordinary photograph. It is said that the color prints obtained resemble oiled color prints. The SCIENTIFIC AMERICAN hopes to publish an intelligible article on the subject as soon as it receives trustworthy information.

The Talking Machine as an Aid to Science.—Before the Incorporated Society of Musicians, at London, Prof. Sylvanus Thompson recently discoursed on the merits of the talking machine. He said that young people could hear lower notes than old people, and the animals at the zoo, particularly cats, heard all sorts of sounds that we could not hear. He represented the effect of the difference of the pitch of notes by displaying on the screen waved lines which had been traced by the vibration of sound through an instrument known as the phonotograph. By the invention of gramophones, he said, it was possible to find that these waved lines represented musical sounds as well as variations of pitch. While he could hardly regard the gramophone as a musical instrument, except in certain circumstances, he looked upon it as a valuable scientific instrument.

A Meteorological Station in Spitzbergen.—In the recent progress of civilization there is nothing more striking than the part Spitzbergen—which lies 700 miles north of the arctic circle—is taking in human affairs. It has become a popular summer resort, is the seat of important fisheries and coal mines, and is in communication with the world *via* wireless. Now it is announced that the Norwegian Meteorological Institute is fitting up a first-order weather station at this remote outpost. It will be operated in connection with the wireless telegraph station at Green Harbor, and seems to promise a highly important extension in the field of the present European weather maps. This will be by far the most northerly meteorological station, or scientific institution of any kind, in the world.

The Milky Way and the Glacial Period.—What caused the glacial period—or rather, periods, as there were probably several—is still a subject of continual controversy among geologists. To the long list of suggested explanations the latest addition has just been made by Dr. Rudolf Spitaler in a contribution to the *Meteorologische Zeitschrift*. He sees a possible cause in the shifting of the earth's position with respect to the Milky Way, incidental to the precession of the equinoxes. This hypothesis assumes that the heat received from the stars is an important factor in terrestrial climate. Since the stars are crowded in the region of the galaxy, and the great majority of the hottest stars, i. e., those of the helium type, are found in the same region, it would follow that the gradual change known to have occurred in the angular position of these stars might modify the distribution of temperature over the earth's surface.

Biological Survey of the Panama Canal Zone.—With the co-operation of several of the executive departments, the Smithsonian Institution and of the Field Museum of Natural History, a party of about ten naturalists were sent last year to the Panama Canal Zone. Large collections of biological material were obtained, including specimens of a considerable number of genus and species new to science. The Republic of Panama was so impressed with the importance of the work that it invited the Smithsonian Institution to extend the survey within the bounds of that country, which was done, with gratifying results. When the Panama Canal is completed, the organisms of the various watersheds will be offered a ready means of mingling together. The natural distinctions, as regards the distribution now existing, will be obliterated, and the data for a larger understanding of the fauna and flora will be placed forever out of reach. Moreover, a great fresh water lake will be created by the construction of the Gatun dam, and the majority of animals and plants inhabiting that locality will be driven away or drown. Hence the value of such an expedition as this.

Aeronautics

Aeroplanes for the French Army in 1912.—The announcement is made upon good authority that the French War Department will purchase no less than 350 aeroplanes for the army during 1912. These machines will be ordered in lots of 20, 50, and even 100, and they will be supplied by all the leading French constructors. The army aeroplanes are to be known as "avions," in commemoration of the first army aeroplane built and experimented with by Clement Ader in 1897, and which is now preserved in the Conservatoire des Arts at Metiers at Paris.

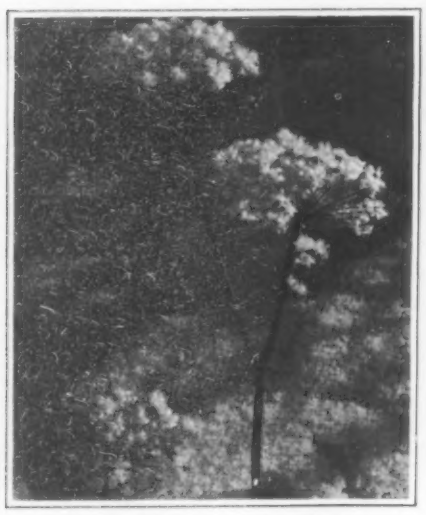
Surprising Flights by an Amateur.—At Nassau Boulevard Oliver Sherwood, an amateur aviator, has made some astonishing flights in a Curtiss type biplane equipped with a 6-cylinder Kirkham 4-cycle motor. The third time he had ever been up in an aeroplane he remained aloft 36 minutes, while during his fourth flight he made a circle of the field with his hands off the control wheel. Another day he flew to Mineola on a shopping expedition. After purchasing some hardware and supplies, he strapped the bundles on his machine and quickly flew home again. He frequently attains an altitude of from 1,000 to 2,000 feet, and he has shown himself to be a born aviator.

A New Generic Name for Aerial Screw.—When the screw is placed in the rear of flying machines, it is correctly called a propeller. When, however, it is mounted in front, and performs the function of pulling the machine along, it can no longer be called a propeller with strict technical accuracy. Hence we find that some flying machine builders prefer the term tractor. A Detroit company thought that a general term was required, applicable to screws, whether they pushed or pulled the machine through the air; and offered a prize of $25 for the best suggestion. That prize has just been won by Raymond W. Garner, of Davenport, Iowa. His word "spiron," received the company's prize of $25.

The Los Angeles Aeroplane Meet.—The third international aeroplane meet to be held at the Dominguez field in Los Angeles, will open on the 20th inst., and continue until the 28th. Among those entered are some of the best known fliers, including Bud Mars, Cal P. Rodgers, P. O. Parmalee, Howard Gill and the Misses Harriet Quimby, Blanche Scott and Mathilde Moisant. They will compete for the prizes on the percentage basis, fifty-five per cent of the gross receipts being paid to the aviators. Each contestant will have to undergo severe tests, and have his machine inspected by a committee of experts before he will be allowed to enter into the meet. The rules of the speed contest are also very stringent. It is planned to give night flights and a spectacular display of fireworks as one of the novel features of this meet.

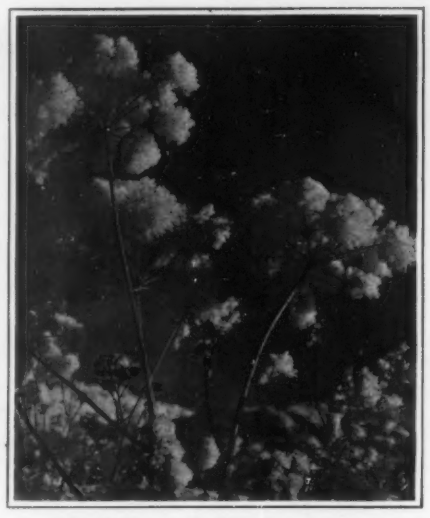
The Duration Record and the Longest Non-stop Flight.—The longest time in continuous flight was raised last year (September 1st) from 7 hours and 18 minutes, scored by Tabuteau in 1910, to 11¼ hours by Alexander Fourny, who covered 720 kilometers (447.38 miles) on his Maurice Farman biplane. On December 24th last M. Gobé, on a Nieuport monoplane, remained aloft 8¼ hours while traversing a closed circuit in the "Criterium de l'Aero Club" contest and covered 740 kilometers (459.81 miles) at an average speed of about 55¾ miles an hour. Gobé is therefore the winner of the contest, which is for the greatest distance over a closed circuit in one continuous flight. He carried 220 liters of gasoline and 60 liters of oil aloft at the start, and had enough left for 3 hours more when he landed. The flight was made in a wind of 10 to 12 miles per hour, which put no little strain on the aviator.

Aviation on Long Island.—During the first part of December advantage was taken of the wonderful weather, which resembled "Indian Summer," by several aviators at Nassau Boulevard and Mineola in order to try out their machines. Frank Boland, a founder member of the Aeronautical Society, has made daily flights in his novel tailless biplane—a machine, by the way, which does not infringe the Wright patent, since it has neither warpable wings nor a vertical rudder—at Mineola, and William Kimmerly has also flown there in a Curtiss of his own construction, fitted with the novel 4-cylinder, 2-cycle motor heretofore used for experimental purposes by Wilbur Kimball. No less an authority than Capt. Thomas A. Baldwin states that Boland has flown in winds that the birds refuse to navigate. One day some time ago this daring experimenter started *with* the wind when it was blowing between 30 and 40 miles an hour. His machine shot across the field so quickly that he was obliged to land while traveling at about 100 miles an hour. The friction of the skids on the ground was so great that the biplane turned several somersaults. Luckily it was not severely damaged, nor was Boland hurt a bit. We expect to publish illustrations and a full description of his machine in the near future.



"Jack Frost's" mock azaleas.

Ice flowers on St. Moritz Lake.



Dead stalks in winter bloom.

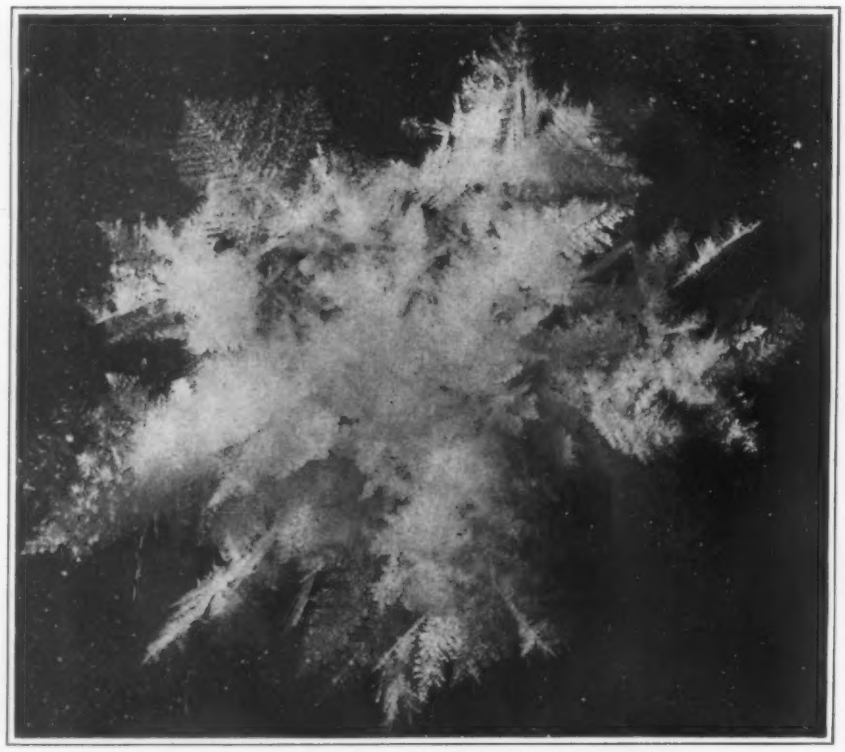
Frost Flowers and Snow Crystals

How Water Vapor is Turned into Fantastic Shapes

By John Swaffham

ALMOST everyone may be supposed familiar with the substances that we call snow, ice, and hoar-frost; again, almost every child may be presumed to know that these three substances are, in reality, no more than as many forms of water. Whether all who know this much, know further that snow, hoar-frost and ice are one and the same form may be open to doubt.

One of the lasting benefits which photography has conferred upon the world is certainly the ability to place on record natural phenomena so that, however rare or special the subject of a negative, every person can examine this subject in a print almost as well as though the natural object were before him. In certain cases the examination is easier and more instructive when made thus indirectly than it could be under natural conditions. This is certainly the case when we desire to study the real nature of snow or hoar-frost. Every flake of snow or atom of white hoar-frost is a crystal, so fragile and perishable that a touch, the sun's first rays, or even a man's breath, will ruin its form in an instant. Those forms, again, are usually small as well as frail. To be examined as they—so to speak—"grow," they must be examined by the naked eye, or at best by a small magnifying-glass. They are too perishable ever to be transported within range of the microscope. But photograph them, and the problem of examination is as easy as it was before difficult. The picture on your negative can be enlarged at will, to a thousand diameters if you please, whether whole or in part. Thus a simple mechanical process will teach you the complete story hidden within the petals of a December night's frost flower on, let us suppose, a midsummer's day ten complete years after the morning sun destroyed the original crystal.



Frost flower with delicate fern-like petals.

When the atmospheric temperature on the surface of the earth becomes chilled below a certain point, we saying that it is freezing. At such a time the water in ponds and lakes begins to congeal or to assume the solid state, known as ice. When the frost is very severe, the water in rivers, even the sea, does likewise.

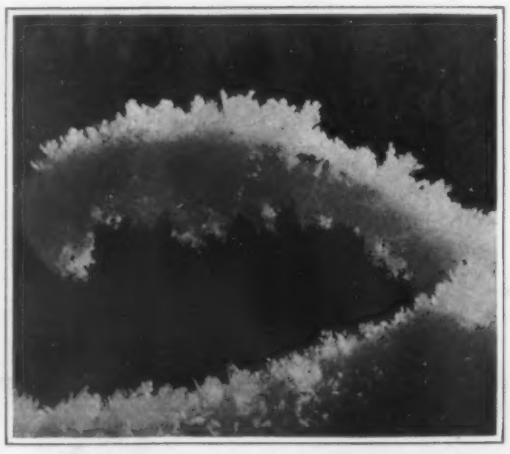
But water does not freeze, become ice, all in a moment or over its complete surface, although the sight of a pool on the morning after a frosty night might lead us to suppose that this was the case. The process is long and complicated and occurs somewhat in this wise.

Water cannot begin to assume the solid state, until at least the entire upper surface has become reduced in temperature to the freezing-point as indicated on the thermometric scale. But even if a mass of water be cooled to this point, congelation or the assumption of the solid state, does not necessarily follow. If the water be in a state of absolute rest, and its surface not in contact with any solid body other than the sides of the containing vessel or pool; and if these sides be of that almost complete smoothness and regularity which can hardly occur in nature, or be secured artificially without the use of a container of glass or marble; the surrounding temperature may fall far below the freezing point and the liquid still remain liquid. When a body of water is in this condition a very small matter will cause it to freeze with great rapidity. It will begin to freeze if you agitate the surface or introduce a single particle of ice, and this so fast that the surface will be covered with ice in but a minute or two.

But this is a laboratory experiment. The waters which are exposed to the airs of heaven in the natural channels and hollows of the earth, seldom have an

(Continued on page 75.)

Like a swamp of cinnamon ferns.



Ugly twigs clothed with hoar frost.

Frost flowers on a field of snow.

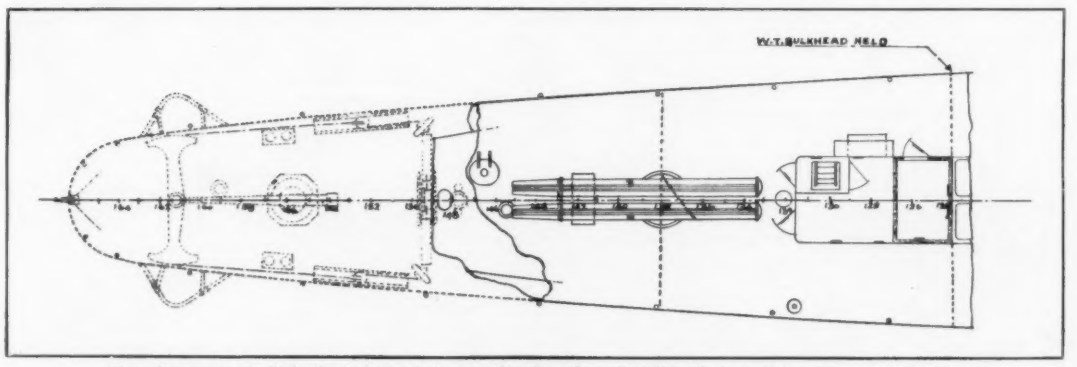
FROST FLOWERS AND SNOW CRYSTALS

An Amazing Tale of the Sea

How a Destroyer Lost Forty Feet of Her Stern Off Cape Hatteras

THE furious gales which lashed the North Atlantic during the last week of the old year and the first week of the new, have furnished some strange stories of the sea; and for many a day to come the officers and men of the United States Atlantic fleet will tell over the experiences of that fortnight of tempestuous winter weather.

We doubt whether, in all the history of torpedo-boat service, there can be found a story so full of dramatic interest as that which has just been written in the log books of the destroyer flotilla, which sailed with the Atlantic fleet under Admiral Osterhaus, for the Guantanamo station in the island of Cuba. The gale broke upon the fleet with the suddenness which characterizes the Gulf Stream weather; and during the night the wind rose to 70 miles an hour—hurricane force—and blew with greater or less violence, as far as may be judged from wireless reports, for forty-eight hours.



The schooner cut entirely through the destroyer, the after, dotted portion of the hull dropping to the bottom.

Deck plan of after 75 feet of destroyer "Warrington."

So heavy was the sea, that large cruisers like the scout "Salem" were so disabled as to run for a home port; while even the big dreadnought "Delaware," in spite of her lofty freeboard of 26 feet, was boarded by heavy seas that crushed in her boats, tore them loose from the fastenings, and swept them overboard.

If the elements could play havoc with 20,000-ton ships of battleship weight and strength, what must have been the effect upon the light, lean destroyers of less than 1,000 tons displacement? Little wonder is it, when wireless messages began to flutter in to the admiral's flagship from out of that tempestuous night, telling him that these little craft were having a hard time of it in holding their appointed course and station, that he flashed back the signal for each boat to make for the nearest harbor. In groups of three or four, or singly, the little craft found their way to shelter—several to Bermuda, some to Norfolk, and one or two breasting it out manfully to the designated point, Guantanamo, Cuba.

At the present writing, it would seem that the whole flotilla came through that heavy ordeal structurally intact—a tribute to good design, carefully-drawn specifications, honest workmanship, and last, but not least, excellent handling by the young officers to whom falls the command of these smaller craft of the navy.

The interest of the present article, however, centers in one particular destroyer, the "Warrington" and a certain wild night in Christmas week, when a northerly gale was lashing the waters off Cape Hatteras into one of their periodical moods of vicious turbulence.

The "Warrington" formed one of the squadron of five destroyers, which was fighting its way north, in line ahead, at a speed of from 12 to 14 knots, against a strong wind and heavy sea. It was between the moons—and the night was overcast and very dark. Driving before the storm, with her reefed lower sails "wing and wing" and a smother of foam at her bows, came a large coasting schooner. Her course intersected that of the destroyers at an angle, as far as can be judged, of about 50 degrees. The watch forward, if she had any, must have been asleep, or coiled up under the weather bulwarks, for he failed to see the many lights of the far-strung line of destroyers; and the sight of them may have been shut off from the man at the wheel by the foresail. Whatever the conditions, the schooner came driving right through the line of destroyers, striking the "Warrington" just abaft of her after torpedo tubes, and just ahead of her after watertight bulkhead. Cleanly, as though it were a keen knife of steel, her stem cut through the vessel, completely severing forty feet of her stern from the body, stripping the hull plating, with its framing, clear of the shafting, and leaving the latter protruding aft of the gaping wound in the ship, like a couple of long, trailing tentacles.

Asleep in bunks within the compartment into which the schooner thus rudely intruded, were eight petty officers, of whom four were knocked insensible, and somewhat, though not seriously, injured. Of the other four, two escaped by lifting themselves over the jagged end of the main deck above, and two escaped by a door in the forward bulkhead, dragging the injured men with them just in time to escape the inrushing water.

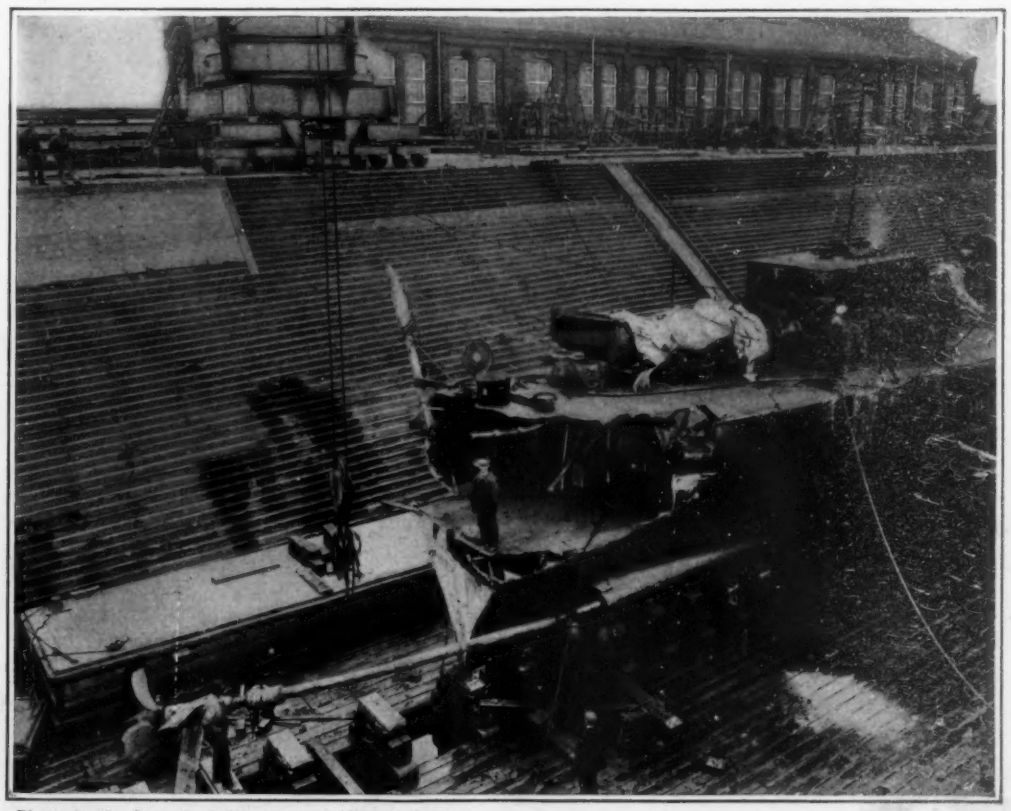
The water flooded this compartment, and entering through the open door, flooded, also, the compartment ahead up to the watertight bulkhead, indicated by a dotted line in the accompanying drawing. Fortunately, in spite of the heavy sea that was running, this bulkhead held.

Now here was a pretty mess! A "frail" (not so very frail as the event proved) destroyer, disabled in heavy weather off Cape Hatteras, 150 miles from the nearest drydock (at Norfolk) with forty feet of her stern gone and another fifty feet open to the sea!

The wireless sent out its call, however, and brought the revenue cutter "Onondaga" to the rescue. Lines were got aboard, and, after a long tow of 48 hours, the staunch little "Warrington" was brought in through the Capes, and safely docked at the navy yard.

Here the torn plates will be removed, and a new stern built on; new shafting will replace the curiously twisted shafting which shows so oddly in the photographs; and in a few weeks the "Warrington" will be back in the fleet—staunch as ever, in spite of her rough dismemberment.

Therefore, from now on let no one say that the destroyer is a fair-weather craft only. She can take the hard knocks of service on the high seas with her bigger sisters; and when the supreme test of war is upon her, she will answer to every call of what is acknowledged to be one of the most exacting branches of the service.



Photos by the *Journal of Commerce and Virginia Pilot.*

Eight petty officers were asleep in this compartment at the moment of collision, all of whom escaped. Note propeller shaft and struts.

The "Warrington" in drydock at Norfolk yard.

HOW A SCHOONER SHEARED A DESTROYER.

Sour Milk and Longevity

THE dietetic use of sour milk was advocated by Metchnikoff for the following reasons: According to his theory, the principal agent in senile degeneration is the putrefaction of imperfectly digested food in the intestines. The products of putrefaction are absorbed by the blood, and result in slow poisoning. This process requires the presence of a particular group of bacteria. While it is possible to some extent to prevent the entrance into the body of such bacteria, a simpler and more effective plan is to introduce another set of microbes having the power of destroying or neutralizing them. Metchnikoff proved that the bacilli that produce lactic acid, i. e., those that ferment the milk sugar and produce sour milk, fulfill this requirement. Since his theory was published many laboratory preparations containing cultures of the lactic bacillus have been put on the market.

Longevity appears to be the rule in many parts of the world where fermented milk is a common beverage. Thus it is reported that Bulgarian peasants, living under conditions which in general are far from hygienic, frequently attain ages ranging from 100 to 120 years. The relation of sour milk to longevity forms the subject of a forthcoming book by Dr. Loudon M. Douglas, entitled "The Bacillus of Long Life."

Time Signals by Wireless

SINCE May 23rd, 1910, the Observatory of Paris has utilized the wireless station on the Eiffel Tower for sending a daily time signal at midnight. As France has now adopted Greenwich time, it is probable that the hour of this signal will be changed from midnight to 11:45 P. M., in order to avoid confusion with the signal sent at midnight, Greenwich time, by the wireless station at Norddeich, Germany. The latter is communicated by the German naval observatory at Wilhelmshaven. Since November 21st, 1910, a second time signal has been sent from the Eiffel Tower, daily, except Sundays and holidays, at 11 A. M.—a more convenient hour, for many purposes, than midnight. Lastly, the Observatory of Rio de Janeiro is preparing to follow the example of the French and German institutions, and will shortly communicate the time to the world by wireless telegraphy.

Training Captains of Industry in Germany—II

High Schools in Which the Science of Business is Taught

By Waldemar Kaempffert

THIS is the second of a series of articles intended to show the part that science plays in German industry and commerce. With this object in view the author of the article, Managing Editor of the SCIENTIFIC AMERICAN, *was sent to Europe by the publishers to study German industrial conditions.*

On August 26th, 1910, a number of students of the Commercial High School of Cologne, accompanied by three professors, landed in New York. Their object was to study American and Canadian industrial conditions on the spot and not in the lecture room or library. As a matter of news the arrival of these Cologne students and their teachers was not permitted to pass unrecorded by the press of New York, and yet the true significance of that journey of many thousand miles, undertaken by young men who would some day occupy commanding positions in German factories, was hardly appreciated either by the newspapers or by American business men.

Long before they steamed into the harbor of New York these students had been acquainted with the United States, with the giant buildings of New York, with the blast furnaces of Pittsburgh, with the automobile industry of the Middle West, with the dry goods stores of New York and Chicago, with the wheat fields of Montana, by lecturers who had prepared them, both in the classroom and on shipboard, for what they were to behold. When they saw the yelling brokers of the Stock Exchange, the activity of a great department store, the manner in which a mail-order house conducts its business, the slaughtering of animals in Chicago stockyards, they received the finishing touch, as it were, of a scientifically planned commercial education. The industries of twenty-six States were thus studied as well as those of the commercially more important regions of Canada. When the journey was completed, the students of the Cologne Commercial High School knew more about America and the manner in which Americans conduct their industries than nine-tenths of the inhabitants of New York or Chicago.

Teaching a Man on the Spot.

Educational journeys such as these have been undertaken more than once by matriculants of the school in question. In 1905 the industries of Northern Germany were similarly studied; in 1906 Western Europe was traversed; in 1907 the commercial possibilities of Italy, Greece, Turkey, and the near East were investigated; and in 1908 the manner in which business is done with savage tribes was studied along the equatorial coast of East Africa.

Exceptional as these extensive educational journeys are, nevertheless, they must be regarded as typical incidents in the education of the German business man; for in Germany, business means something more than buying hats cheap and selling them dearly, something more than mere money-making. The head of a great industrial undertaking is a scientist in the true sense of the word. He is as far removed from the thought of making money, simply for the sake of money, as a civil engineer is removed from the thought of making profit out of a bridge which he is commissioned to design. It is the science of the thing that counts in Germany, the way in which a particular commercial problem is to be solved. Conduct your business, however small, scientifically, says the German, and the money will take care of itself.

It would be absurd to attribute to the remarkable commercial high schools and academies of Germany, all the credit for the success of the German business man; but the part that they play in commercial life is anything but small. They teach the technique of commerce, the economic relations of one industry to another, the significance of modern banks and railroads, and above all they teach the attitude which the business man must assume toward the State, the world, and his immediate competitors in business.

The Great Commercial High Schools.

How that scientific attitude is imparted, the curricula of the great schools at Mannheim, Munich, Cologne, Frankfurt, Leipsic and Berlin show at a glance. In the first place the part played by the business man, giant or pigmy, in the body politic, is driven home by lectures on economics and finance. At the very outset, the student is made to realize that he is not merely a little cogwheel in an infinitely complicated train of gears, but often only a single tooth on a tiny pinion; that if the whole mechanism is to move faultlessly, he must keep his particular part well-oiled and in perfect condition. Training such as this unquestionably lifts a man above the level of mere shopkeeping.

So too the method of conducting a business enterprise is taught from a liberal and scientific point of view. In America the so-called business college lays great stress on bookkeeping. In Cologne and Frankfurt bookkeeping is simply one of many subjects listed in the curriculum of the high school, and then it is taught chiefly in its relation to the conduct of a factory, a bank, a great stock company or a great export house. The term "Handelswissenschaft" (commercial science) is the broad title under which the many phases of bookkeeping in the broader meaning of the term are included. How all-embracing the term is may be gathered from the fact that in the commercial science departments of these German high schools lectures are delivered on cost calculation in factories, the organization of German and American export-houses, bookkeeping for stock corporations, the theory and practice of bookkeeping and balance-revision in banks, and the management of banks and exchanges from the bookkeeper's standpoint.

Business Geography.

We Americans are accustomed to regard geography as a subject which should be studied only in the grammar school out of a large book containing many gaudy maps and pictures of Turks, Hindus, Chinese, and South Sea Islanders and informing one in a dull, leaden way that the population of China is about 465,000,000; that the Hindustanee girls marry at an appallingly early period and promptly drown or burn themselves when their husbands die; that Mohammedans have many mosques and many wives, and that Paris is the capital of France and the home of many fashionable dressmakers. Geography is one of the subjects taught in the German commercial high school, but taught by political economists. Here are the titles of some of the courses regularly delivered at Cologne: "The economic geography of the high seas and its relations to steamship traffic;" "geographical studies of medieval and modern cities;" "cartography for business men;" "the fisheries of the great oceans and the relation of the more important fishes to modern political economy;" "the important harbors of the United States;" "traffic conditions in Poland;" "coasts and their commercial significance;" "the climate and mineral products of Chile."

Closely connected with the study of commercial geography is the study of raw materials and manufactured products. Chemical and physical laboratories are to be found in the schools and here the student is taught enough chemistry, physics, mechanics and engineering to buy intelligently textiles, gas-engines, rails, paper, and the thousand and one products that are employed in our daily lives, as well as to manage the great plants in which raw material is converted into useful articles. The lectures on a particular country, for example, are accompanied by a scientific discussion of the products of that country. Sweden is not simply part of a peculiarly formed peninsula that droops from the North of Europe, but a country that produces a variety of iron remarkable for its chemical and physical properties. Italy is not simply the foundation of a volcano or a happy hunting ground for archeologists, but a producer of olive oil, a product which can be studied chemically and accordingly distinguished from other edible oils.

Science as a Business Asset.

And so the student learns enough of microscopy to know textiles as a dealer in textiles should know them, enough of biology to appraise the commercial value of industrially useful plants, enough chemistry to understand the process of iron smelting and cotton dyeing, enough of electro-chemistry to understand how aluminium, carborundum, sodium, potassium, calcium carbide and other products of the electric furnace are obtained.

Even mechanical and electrical engineering are subjects of which the elements at least are taught to the German student of commerce. And after all, why not? Why should not the manager of a great textile plant know something of the steam engines and dynamos that drive thousands of looms and spindles? Why should not a factory proprietor know something of the relative value of steam, oil, and gas engines as prime movers. In the great commercial high schools, accordingly, we find that engineering is taught side by side with bookkeeping and finance. Not only steam and electrical engineering find a place in the curriculum, but also telephone and telegraph engineering, the utilization of waterfalls for the generation of power, the relative value of turbines and reciprocating engines in factory power plants, methods of mining coal, iron, and other metals, as well as other phases of modern engineering in which a modern works manager ought to be interested.

To supplement the lectures of the class-room the students are taken in a body to industrial plants where they may see in actual operation the machinery on which their professors have lectured. Thus, Prof. Eckert, Director of the Cologne Commercial High School, guided his students through the cement factories of Bonn, the paper mills at Neuss, the belt works at Barmen, the zinc-smelting plant at Berg-Gladbach, the great steel works at Oberhausen and Essen, the gas engine shops at Deutz, and about seventy more of the important plants in western Germany.

The "Humanities" in Business.

Intensely practical as this training unquestionably is, it would not be German if it were not also liberal and broad. What our forefathers delighted to call the "humanities" are not ignored. At Frankfurt, Cologne, Berlin, and other commercial schools, philosophy, history, even art are not considered out of place within the school walls. In last year's course at Frankfurt there were lectures on æsthetics, on logic, on the history of philosophy in the nineteenth century, on Napoleon, on experimental psychology, and on a score of subjects which an American would deem out of place in the curriculum of a commercial high school.

Languages, too, are taught; but that is to be expected of a nation that sends to South America and Japan, salesmen who speak Spanish and Japanese. Although the language courses are naturally conducted primarily with the commercial object of enabling the graduate to deal with the foreigner in his own tongue, still they are not free from humanistic tendencies. At Cologne, the student is instructed not merely how to talk the business language of the United States, England, and France, but also something of the literature of the countries with whose business men he will some day be thrown into intimate contact. Byron, Shelley and Keats are read together with English text-books on English commercial methods. Lectures on Molière alternate with practical lessons in the financial jargon of French banks. Not only are English, Spanish and French taught in this way, but Russian, Turkish, Portuguese, and even Arabic.

Political Economy.

Political economy, in other words the science of business in its largest sense, is made the most important subject in every commercial high school. Almost every lecture drives home the economic importance of the simplest business events. The organization of banks and their relation to modern industries, the economic importance of means of communication, ancient and modern theories of exchange, colonial expansion as a means of increasing export trade, all these and similar subjects are discussed from the broad viewpoint of the economist. There are lectures on the history of economics; German contributions to economics in the nineteenth century; the importance of proper standards of weights and measures; trusts and their merits and evils; the philosophy and economic basis of modern socialism; the relation of the press to modern industry; the government of a modern city; statistics and how they should be employed, in a word, lectures of a most practical kind on the larger aspects of business activity. Since he must deal with money, the student is given a thorough grounding in modern banking, and particularly in the relation of the capitalist to industry. What is more he is taught how his own funds should be invested in mortgages, stocks, bonds, and other securities.

Colonial expansion is so important a phase of Germany's recent development, that nearly all the great economical high schools devote special courses to its discussion. Germany now has a sure footing in South West Africa, Kamerun, Togo, East Africa, New Guinea, the Marshall, Brown and Providence Islands, Kiow Chow, the Carolines, and the Samoan Islands, all of them acquired for business reasons. These colonial possessions are new markets of which the most must be made. That end is attained by dispelling any false notions the student may entertain of the natives that inhabit Germany's colonies. He is taught to distinguish one African tribe from another and not to lump them all roughly under the all-embracing heading, "savages." The colonial policies of England, Holland, the United States, Spain, and France are critically compared, particularly the relations of the conqueror to the conquered. Most important of all is the scientific utilization of colonial resources, to teach which elaborate lec-

tures are delivered on the management of plantations and cattle ranches.

Since every business man sooner or later finds himself the complainant or the defendant in an action, a very thorough law course is included in the curriculum of every commercial high school. Not only is the general commercial law of the German Empire taught, but corporation law, the law of common carriers, patent law, banking law, and maritime law as well. If he is not actually able to practise law when he emerges from the high school the student at least knows how it ought to be practised and what his legal rights are in any ordinary conflict that may arise.

The Student Body.

Let it not be supposed that the German commercial high school is intended for boys. The students are for the most part young men in their twenties, who have spent years of study in elementary schools and "gymnasiums," as the Germans call the preparatory schools that ultimately lead to the great university. Among the students are many merchants, bank officials, and government officials who feel the need for a more profound insight into the mechanism of modern commerce. In granting the charter of the Commercial High School of Berlin, the Government stipulated that the school was to be maintained at the level of institutions of university rank, such as the University of Berlin and the Polytechnic Institute of Charlottenburg. "Commercial universities," then, rather than "commercial high schools" is the more appropriate designation for these remarkable institutions. They perform for the German intended for a mercantile career the same function performed for the American engineer by such engineering schools as the Massachusetts Institute of Technology and Stevens Institute, and like the engineering schools they are essentially scientific.

Curiously enough the American "business college," an institution privately financed and conducted solely for private gain, antedated the German commercial high school by fully fifty years. It was erected to supply the insatiable demand for clerks and bookkeepers that naturally followed the ready exploitation of the country's natural resources. But business as a science has never been taught within its walls. It still offers only courses on typewriting, bookkeeping, penmanship, and spelling. The German commercial high school or university was erected by business men to supply the demand for scientifically trained managers of large enterprises that has arisen within the last ten years. With us the demand is just as keen, but only the larger universities have made an attempt to meet it. As yet we have made no consistent attempt to train the coming manufacturers scientifically as we train our engineers and our chemists. Until we do we are not likely to conquer the German student, who has taken our commercial measure by visiting us in our own country, inspecting our factories and studying our banks and department stores, so that he returns to his home knowing nearly as much of our manufacturing and selling capabilities as we do ourselves.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Battle-cruisers vs. Destroyers

To the Editor of the SCIENTIFIC AMERICAN:

Is not the building of scouts and battle-cruisers, as advocated in your recent Naval Number, a waste of money?

Are not the large and powerful destroyers more valuable as scouts than either of the above types? They are faster and less easily seen, especially the oil burners; and ten of them could be built for the price of one battle-cruiser. The battle-cruisers, on account of their thin armor, are no match for the heavy battleships; and even obsolete battleships, if re-armed with the latest guns, could hold their own with them.

Salem, Mass. JOHN PICKERING.

[The battle-cruiser has sufficient offensive power to break through the screen of the enemy's scouts, and ascertain his battleship strength. The destroyer could not do this.—ED.]

Storage-battery Cars in New York

To the Editor of the SCIENTIFIC AMERICAN:

In your "Retrospect of the Year 1911" appearing in your issue of December 30th, and under the heading "Electrical Engineering" you state "note should be made of the fact that the Edison storage battery cars which have been operating during the year in New York city have been giving reliable and satisfactory service."

Your attention is called to the fact that but one Edison battery car has been operated in New York city and that only in an experimental way. The car is not now in commission and has not been for months past. The cars in use on the cross-town lines are equipped with lead storage batteries, of the "Gould" vehicle type.

We trust that you will give the above the same prominence given the error to which your attention is called, which error we are sure was inadvertent on your part. GOULD STORAGE BATTERY COMPANY.

New York City.

The Navy Number and the Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

Permit me to compliment you on the Naval Number of the SCIENTIFIC AMERICAN under date of December 9th. When I read your advertisement stating when it would make its appearance, I was sure that it would be a credit to its publishers, but it was even more than that. It is a monument to the United States navy.

I found your article headed, "On Board a Battleship" very interesting. It gives us landsmen a good idea of what life in the navy is—not all work, as is the consensus of opinion. Your article on "The Fleet and Its Readiness for Service" brings to mind in a striking way the inadequacy of our merchant marine, something that is essential to a nation possessing such a navy as the United States does. It is to be hoped that Congress will see fit, in the near future, to pass laws making conditions more favorable to American shipping firms and builders than they are now. This will enable people to see the American flag floating over swarms of merchantmen in all parts of the globe. As the case now stands, our flag is noticeable by its absence on the high seas. NORMAN MCKAY.

Chicago, Ill.

Two Reports on Gun Fire

To the Editor of the SCIENTIFIC AMERICAN:

In the interesting article by Mr. J. Bernard Walker in your issue of November 25th he describes a phenomenon which occurred during the firing by the "North Carolina" at aerial targets towed by the "Michigan."

Mr. Walker relates that two reports were audible; the first one, "which seemed to come from the vicinity of the target," was heard about 2½ seconds after the gun was fired; the second report took 5½ seconds to reach the "Michigan," and as the range was about 6,000 feet, and the velocity of sound is 1,140 feet per second, this later report of course came from the gun.

Now I believe that the first "report" was caused by the air waves, set up by the rapid passage of the projectile, impinging on the target. That this effect is not noticed during land practice is due, I believe, to the proximity of the earth and natural inequalities of the ground over which the projectile passes, and which produce a constant but modified series of similar sounds.

When the shot is fired skyward, these air waves gradually disperse unless they are violently arrested by contact with the suspended target.

When shooting large birds with a rifle during flight, I at first constantly mistook this "report from the other end" for a hit on the wing feathers, until in course of time I realized that the sound was produced by shots which missed but passed very near the object.

I have noticed also that when a bullet from a high-velocity rifle passes very close to a bird, the sudden pressure seems to cause him considerable distress, from which he does not recover for some minutes. I find that the report from the "target" is not so noticeable when the elevation is less than 30 degrees.

Cunard R.M.S. "Lusitania." "INTERESTED."

Abolishing Postage Stamps.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of August 19th last, on page 169, under the heading of "Abstracts from Current Periodicals," there is a reference to "Abolishing Postage Stamps," and it is quoted that in Bavaria since February 1st, 1910, large consignments are simply stamped with a postmark at the post office, the operation being carried out by machinery. The practice of stamping in this manner has been in vogue for many years in the Dominion of New Zealand, and what is more, for the past six years the postal authorities have permitted the use of automatic stamping machines, and they are now almost indispensable in every business in the Dominion.

The machines are purchased by the user, being certified to and sealed by the department before going into use. All documents requiring stamping, such as postages, receipts, telegrams, drafts, bills of exchange, bills of lading, etc., are stamped with the necessary values by the machine. Periodical readings are taken by the Postal Department, and payment made on a debit note.

The advantages to the department are the saving in cost of manufacturing postage stamps and the clerical labor in the issue of stamps, while the advantage to the commercial man is the absolute protection against peculation by the office boy, whose opportunities while in charge of the petty cash for postages are unfortunately taken advantage of to an extent only too well known by the whole commercial world.

Stamping machine impressions are *not negotiable*, as in the case of postage stamps. Wrong additions in the postage book, overcharging postages, abbreviating telegrams, etc., can avail the office boy nothing, because he has to manufacture his postages, etc., as he requires them, and being without petty cash he is perforce kept honest.

He certainly might venture upon the sale of a few stamped envelopes, but detection is swift because each machine has a number which is recorded at the post office, and impressions are traceable to the office of origin in a few minutes.

The protection against fraud on the government is absolute. There are thousands of mechanics in the world who could forge postage stamps and dispose of them, they could certainly forge the stamping machine impressions, but their labor would be in vain because there is no monetary value in it.

The list of users and the testimonials which I inclose are a striking testimony of its value in our Dominion.

W. H. E. WANKLYN.

Christchurch, New Zealand.

Awaiting an American Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

I was glad to see from the September number of your paper that you are giving some space to the discussion of the subject of the American mercantile marine.

I live in Sydney, Australia, having come over here thirty years ago. Since then I have crossed this ocean eight times, having been an importer of American goods. I wish now to draw attention to the development of that market. Thirty years ago one or perhaps two sailing vessels left New York or Boston monthly with American merchandise for Australasia. To-day quite a number of steamers leave New York monthly, laden with American goods. During the six weeks preceding November 4th, nine steamers, each carrying three and one-half million feet of timber, and one steamer, the "Admiral Bonson," with general cargo and sixty horses, sailed from Puget Sound and California ports direct to Australia. Two steamers of the Union Steamship Company of New Zealand sail every month, and find sufficient patronage to trade between California and New Zealand *via* the French island of Tahiti.

The ship on which I am traveling had to refuse between 3,000 and 5,000 tons of general merchandise, as there was no room for it. In addition to this demand for space, the Union Steamship Company of New Zealand (which receives a Canadian subsidy of $180,000 per annum and a New Zealand government subsidy of $100,000) had to charter a British steamer, the "Kish," to carry the freight offering. Do not suppose that the goods filling these ships are all Canadian. Many thousands of tons of American goods, automobiles, typewriters, sewing machines, and general merchandise from the Eastern and Middle States, are shipped by these lines. The steamship "Kish" carries one hundred and sixty blood horses for a Kentucky breeder, Mr. Wheatcroft of Lexington, for the Australian market. The "Kish" has about 6,000 tons of general cargo, including many thousands of cases of Washington and Oregon pears and apples. In addition to these steamers, Howard Smith & Co. of Melbourne, Australia, run a monthly line of steamers loading American goods at Seattle and San Francisco for Australia, much of the trade of which comes from the West. Not one of these ships flies the Stars and Stripes. Surely this growth of American exports should induce the American public to encourage a mercantile marine of their own. Please note that I am instancing only about five or six weeks' sailings from the Pacific coast alone for Australia.

The question of the value of good merchantmen to assist the navy is too large to discuss here. I do now state, on the authority of an American consular officer in Australia, that the American fleet of warships had a very anxious time in New Zealand and Australian waters, owing to the delay of their (foreign) colliers to arrive with coal. Navy officers do not talk, but the fact remains. I will not worry you with all that could be written, but I may say that the (?) fleet had to coal three different times off Albany, West Australia. On their arrival there our collier with coal awaited them. They handed that out to a number of ships, so as to give them enough to reach Manila. Before all the ships had sailed two other colliers arrived, and the ships finally got their bunkers pretty full and proceeded on their voyage.

If you publish the whole or part of these particulars, it may cause people to think. They are a long time acting. FRANK COFFEE,

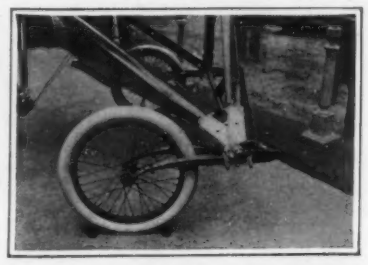
On Board S.S. "Zealandia."

Float of Voisin hydro-aeroplane.

The Third Aviation Salon at Paris

Interesting Aeroplanes and Their Constructional Details

By Stanley Yale Beach



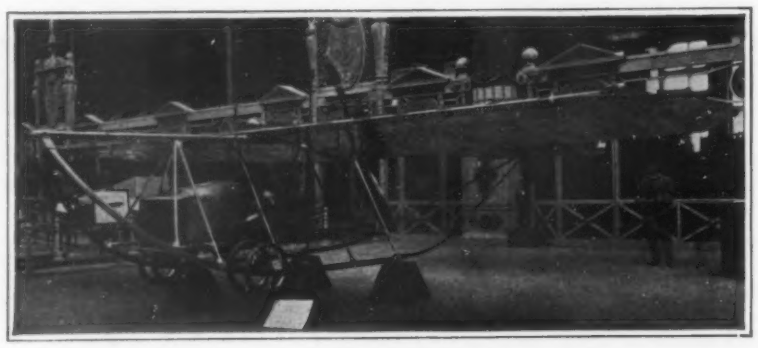
Leaf-spring fork of Blériot monoplane.

THE third International Aviation Salon was held in Paris from December 16th to January 2nd. It was noteworthy that, as compared with the exhibitions of previous years, the collection of exhibits on view was more or less international in character. The exhibition was held in the Grand Palais, and was opened by President Fallières, who was conducted through the Salon by a committee headed by M. Robert Esnault-Pelterie. As heretofore, the exhibition was organized by the Chambre Syndicale des Industries Aeronautiques, under the auspices of the International Aeronautic Federation and the Aero Club of France.

Although the advance in the performance of aeroplanes has been very decided during 1911, the improvement in the machines themselves has kept pace with it. Besides great structural changes, improvements have been made looking to the comfort of pilots and passengers; and given the Deutsch "taxicab" to begin with, the coach builders will soon be called upon to make closed bodies for aeroplanes the same as they do for automobiles.

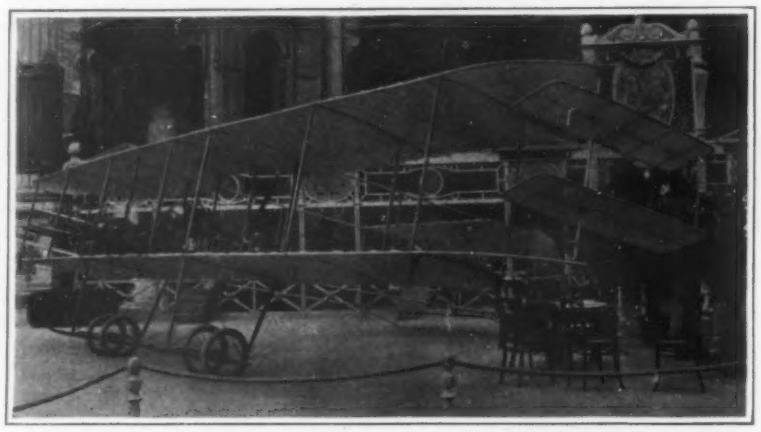
The influence of the monoplane upon the biplane appears in the adoption by many prominent biplane builders of the long covered fuselage, or body, of the monoplane, with the propeller in front, in place of the four spars that were formerly used to support the tail. The Farman brothers still use the latter arrangement, but the lower plane of the Maurice Farman biplane has been very much shortened (see photo.) until it is now no longer than the lower plane of the Breguet, which, by the way, was the first biplane to adopt the monoplane body and propeller placing, several years ago. In order to be in line with the new idea of inclosing the motor, Louis Breguet, two of whose biplanes carried off the honors in the recent military competition, exhibited the machine with covered four-cylinder, water-cooled motor shown in one illustration. The radiator can be seen beside the body. When the bonnet was raised slightly, it gave the front end of the machine the resemblance of a whale with open jaws, and created much amusement. Another Breguet novelty was a side door in the body and a ladder leading up thereto, as shown in one of the small illustrations.

The inclosing of the motor, when a revolving cylinder Gnome was used, was more or less complete in most cases. The complete inclosure of the engine in a very neat manner is shown on the Morane monoplane. The entire body of this machine, designed by Engineer Saulnier, is of pressed steel—a marked advance indeed in fuselage construction, comparable only with the pressed steel automobile frame. Led by Robert Esnault-Pelterie, whose R.E.P. monoplanes have triangular bodies of steel tubing (see SUPPLEMENT No. 1871), a goodly number of the French manufacturers are adopting metal construction. A monoplane with sheet metal wings was on exhibition. Thus the SCIENTIFIC AMERICAN all-steel monoplane racer, illustrated in these columns a year and a half ago, is gradually being approached by the builders. The narrow wings we showed on this machine were approximated by the Blériot racers in the International Cup race last July, and also by the Kaufmann monoplane in the recent Salon. The latter and the Paulhan-Tatin monoplane were the only machines exhibited with disk wheels, i. e., wheels with cloth-covered spokes to reduce air resistance. Emile Train, whose monoplane killed Minister of War Berteaux at the start of the Paris-Madrid race, is another builder employing all-metal construction, even of the wings. M. Train is a pioneer in this line, besides having the distinction of having flown an hour and twenty-five minutes at the Rheims meet, in August, 1910, with a motor of but 20 horse-power.



The "Tubavion" monoplane with underslung car and motor.

A single steel tube forms the backbone, the propeller being mounted on it behind the main plane

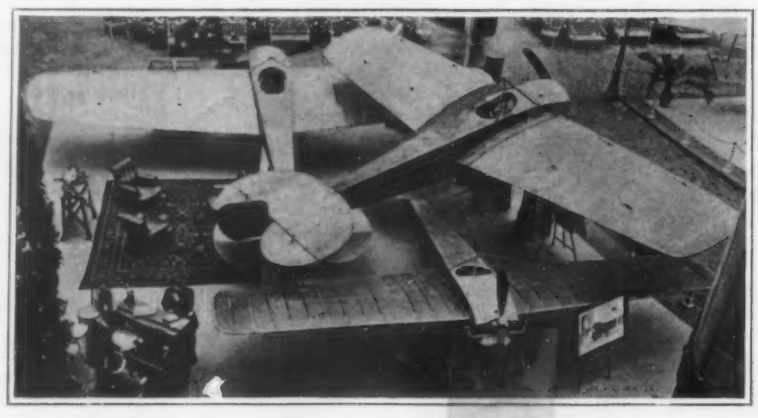


Farman biplane fitted with new form of stabilizing planes.

The two planes are mounted on a vertical shaft which is turned to swing them outward.

"Albatross" biplane (German) viewed from above.

A typical biplane with monoplane body flattened to form a tail the tip of which is flexible enough to steer aeroplane up and down. Note also the pointed flexible wing tips of the upper plane, the short lower plane, and the inclined struts connecting the two.



The Nieuport stand, showing three recent monoplanes.

The machine in the foreground is fitted with a 28 horse-power double-opposed-cylinder motor. It was with this motor that Nieuport had his first success and broke many speed records.

NOVELTIES AT THE PARIS AERO SHOW

Although there was a distinct tendency toward the use of torpedo or fish-shaped bodies. Several monoplanes were shown without any body whatever except a short underslung car, with motor in front under a bonnet, the same as on an automobile. One such machine, the "Tubavion" of MM. Panché-Primard, is illustrated. A long tube forms the backbone and replaces the usual monoplane body. Converging, upwardly-curving skids attach to this tube at front and rear. The propeller is mounted on the tube behind the main plane, and is chain-driven from an extension of the engine shaft, which runs back beneath the pilot's seat. As no starting crank is provided, perhaps this machine is quite up-to-date and is accordingly provided with a self-starter. The tubular backbone and underslung seat for the pilot remind one of the Grade monoplane, a leading German make that has found much favor.

England and Germany were represented at the Salon, which accordingly for the first time had somewhat of an international flavor. A Bristol monoplane, one of which, piloted by the Englishman, Valentine, made a sensational flight over Paris recently, was the chief representative of Great Britain, while an "Aviatic" monoplane and "Albatross" biplane gave an idea of German construction. This latter machine has flexible extensions of the main planes at the rear, as can be seen from the photograph, in place of ailerons. Suitable wires warp these extensions in much the same manner as on the Wright biplane. The Paulhan-Tatin torpedo monoplane, illustrated in our last issue, has upcurved wings which give sufficient automatic transverse stability so that, in the hands of an experienced pilot, no warping is needed. All the "Albatross" machines are fitted with double control. More than twenty have been sold to the German government, and six more have recently been ordered. Russia is also a client of the Albatrosswerke. The "Albatross" biplane is typical of the latest biplanes in that it has a monoplane body which becomes flat at the rear and terminates in a horizontal rudder, while the vertical rudder, in the shape of a fin, is placed above the tail. Another point in which this machine is typical of the latest foreign biplanes is that the lower plane is very short. The struts connecting the two planes are, in this instance, arranged diagonally. This arrangement does away with the usual truss wires that were heretofore employed.

The use of a flattened fuselage at the rear, with rudder above the tail, and elevator at its extremity, was inaugurated last summer by Blériot with his racer. He is now using it on his military-type machines, and its use has been adopted by most of the leading manufacturers.

There were many machines on exhibition having novel stabilizing devices, some of them for the maintenance of the equilibrium automatically. The Bronislawski stabilizer, shown in one of our photographs on a Henry Farman biplane, consists of two small planes mounted on a vertical post. Normally these planes are in the position shown in the photograph, but when the machine tips, they are swung out until they are parallel with the main planes. These small planes at

eacn end are worked in conjunction by the aviator. This device is said not to produce any turning of the aeroplane, and hence use of the vertical rudder to correct the same is not required. It consequently does not infringe the Wright patent.

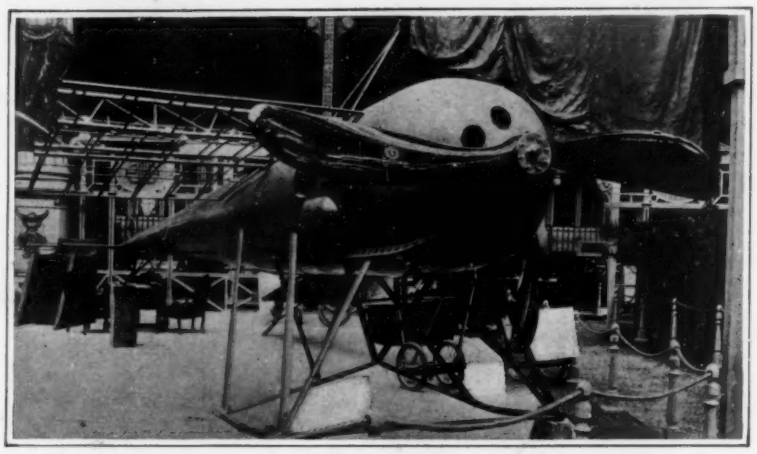
A monoplane having a somewhat similar arrangement of the wings to that just described was one of the features of the show. This machine, known as the de Marcay and Mooney, had wings arranged so that they could be swung by the pilot from the regular position to a position parallel with and above the body. Upon alighting, the pilot can swing his wings back and then run the machine along a road as an automobile.

There were a number of novelties and improved details about the various machines. Among those illustrated herewith is a small propeller which is revolved by the movement of the aeroplane through the air and is made to drive a pump for maintaining the air pressure in the fuel tank. There was also a biplane with electric headlights. This machine recalls the fact that aviator George M. Dyott made the first flight with an aeroplane fitted with electric headlights at Nassau Boulevard in America last October. Mr. Dyott used a dynamo for generating the electricity. Among the details to be noted are the hydroplane float of the Voisin "Canard" and the flat leaf springs used on the latest Blériot military monoplanes. The use of springs in connection with skids is also coming into vogue and is shown on a number of machines, notably the "Albatross." The new Blériot fork makes it impossible for the wheels to give sideways if the machine does not land on both wheels at the same time. A skilful pilot is needed in order to alight without breakage. In one Morane monoplane that was exhibited there were no shock absorbers of any kind, the under carriage resembling considerably that of Santos Dumont's "Demoiselle."

The exhibit of motors this year was very large. All told there were seventy motors on exhibition, varying in size from 25 to 200 horse-power. A number of these were of the rotary type, but the four-cylinder vertical water-cooled type was also in favor.

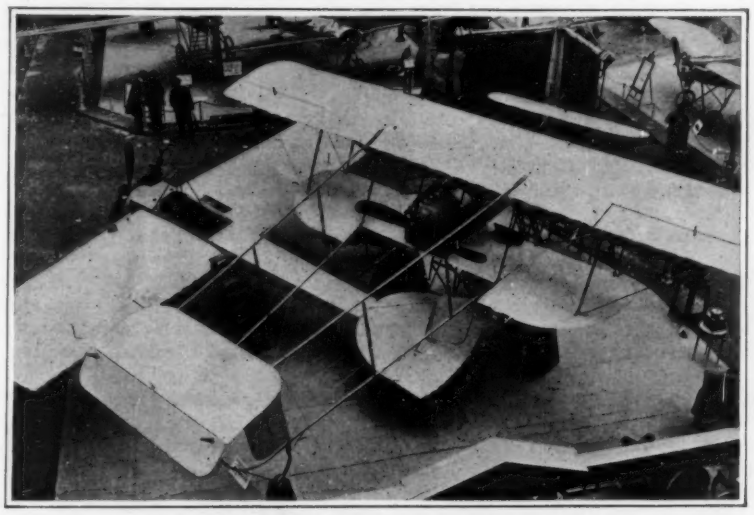
Breguet biplane body with side door and ladder to mount.

Small propeller driving pump for maintaining pressure in fuel tank.



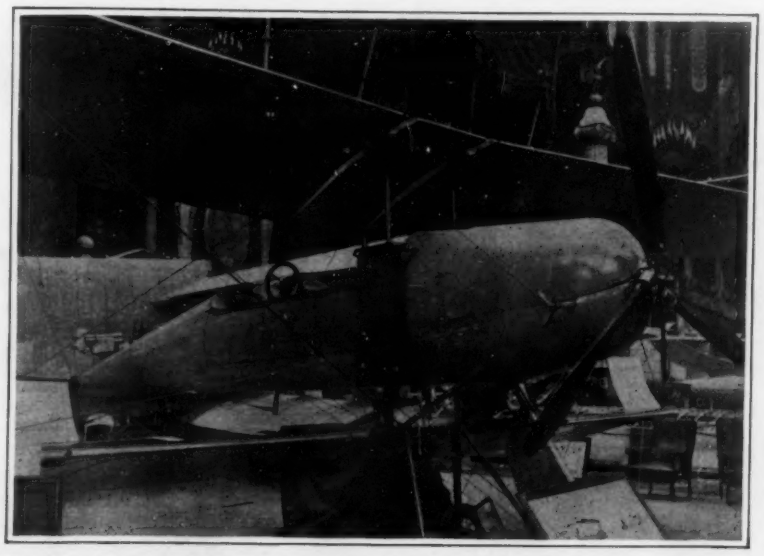
Torpedo shaped Morane monoplane body of pressed steel.

The Gnome motor is completely inclosed. An uncovered section of one wing is seen on the left, in which the construction of steel tubing can be plainly seen.



A Maurice Farman biplane and a Henry Farman monoplane.

Both machines are of the latest type, having ailerons set into the wings. The biplane has staggered planes, the lower being much shorter than the upper, and a single-surface tail. Front and rear elevators are fitted; also twin vertical rudders.



The latest Breguet biplane with inclosed motor and flexible 3-bladed propeller.

The resemblance of the body of this machine to some of the recent automobile bodies produced abroad is striking.

NOVELTIES AT THE PARIS AERO SHOW

The Romance of Echoes

ECHOES form one of the most romantic chapters in the book of Nature.

Which are more severe tests of credulity—the echoes of fiction, or the echoes of fact? There is a tolerable repertory of the former, beginning with the antique fable of that lovely oread who pined away to "a voice and nothing more," and coming down to Paddy Blake, made famous by Samuel Lover:

"But civilly spake, 'How d'ye do, Paddy Blake?'
The echo politely says, 'Very well, thank you'."

However, these are but puerile attempts to vie with authentic marvels.

Some recent observations in Germany and Switzerland upon the reflection of sound from atmospheric strata miles above the earth's surface—which have opened up a new and, in the best sense, romantic field of meteorological observation—make it timely to review the remarkable vagaries of echoes, as they have been recorded from time to time in all parts of the world.

Knowing that the sound-waves of the air are subject to reflections and other deviations analogous to those undergone by the light-waves of the ether, we might, on theoretical grounds alone, arrive at the conclusion that the echo is by no means a simple and uniform phenomenon. And so, in fact, we find that echoes are infinitely various.

Of the better-known remarkable echoes are two classes; (1) those which, owing to the great distance of the reflecting surface from the origin of the sound, send back the latter after a long interval, and are therefore able to repeat, for example, a large number of words or syllables after the original sounds have ceased; and (2) those which, by successive reflections back and forth between two or more surfaces, repeat a single sound many times over. The most familiar instance of the first class is the echo in Woodstock Park, Oxfordshire, described by Sir John Herschel, which repeated seventeen syllables by day and twenty by night. This echo still holds its place in the school-books and guide-books, though it is, in fact, no longer heard, as some alterations in a bridge have completely silenced it. The tomb of Cæcilia Metella, in the Roman campagna, has a famous echo that repeats a whole hexameter verse. In illustration of the second class Herschel cites the echo of Shipley Church, in Sussex, which repeated a syllable twenty-one times; but this echo, also, has vanished. Echoes are frail creatures; a slight change in the architecture of a building or the configuration of a landscape often suffices to extinguish them. All the old books on sound describe the echo of Simonetta Palace, near Milan, which according to the travelers of long ago repeated a pistol-shot fifty or sixty times. Perhaps some of our Italian readers will tell us whether the story still holds good. These instances might be multiplied indefinitely.

In many buildings may be observed the focussing of sound by vaulted ceilings and other curved surfaces; and whispering galleries are a part of the stock-in-trade of guides the world over. That of the Capitol, at Washington, is too well known to need description here. In the Hall of the Caryatides, in the Louvre, which has a cylindrically vaulted ceiling, there are two ancient basins of Sicilian alabaster, one at each end of the room. The slightest whisper uttered at the edge of one of these vases is distinctly heard by a person standing near the other, from which it appears to proceed. A similar acoustic effect is observed in the cathedral of Girgenti, Sicily. If you stand on the steps of the high altar you can distinctly hear anything that is said, even in an undertone, at a spot near the threshold of the principal west entrance, 100 feet away. A story often told of this echo will bear repeating. It appears that one focus of the echo was unluckily chosen for the site of a confessional. The other focus was accidentally discovered by a gentleman, who for some time took great pleasure in overhearing the words intended solely for the confessor, and sometimes invited his friends to share in his amusement. One day, however, as the story runs, his own wife was in the confessional, and he and a friend thus became aware of secrets that were far from agreeable to the husband. Shortly afterward the confessional was moved. Whispering galleries are usually mere accidents of construction; but the famous "Ear of Dionysius," in the quarries of Syracuse, was said to have been designed for the purpose of enabling the tyrant to overhear the conversation of the prisoners in the dungeon adjoining his palace.

So far we have dealt only with echoes that slavishly imitate the sounds that come their way; but there are others possessing more originality. The proverbial Irish echo, which we have mentioned among the echoes of fiction, is not so fictitious as might be supposed by any one unfamiliar with "harmonic echoes." The harmonic echo does not repeat the identical sound that it receives. Lord Rayleigh, who furnished an explanation of these echoes some years ago, quotes descriptions of several from Brewer. For example:

"On the river Nahe, near Bergen, and not far from Coblentz, is an echo thus described by Barthius: It makes seventeen repetitions at unequal intervals. Sometimes the echo seems to approach the listener, sometimes to be retreating from him; sometimes it is very distinct, at others extremely feeble; at one time it is heard at the right, and the next at

(Concluded on page 76.)

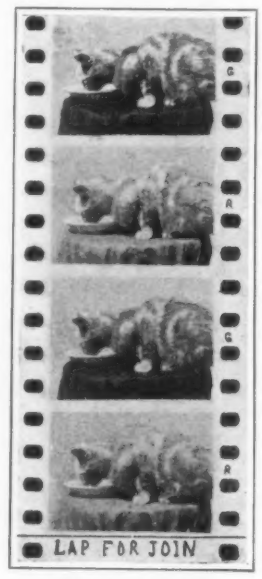
The Kinemacolor Process

Moving Pictures With the Natural Color Reproduced Photographically

So boundless is the variety of the artificial accessories which modern man has called into being and pressed into his service, that at first sight it may appear as if it should be well nigh impossible to discover any general principle on which our complex system of modern arts and industries is built. Yet such a principle is not far to seek. For all the fundamental functions of life have remained practically unchanged since prehistoric days, when primitive man performed his daily activities with little or no other aids than the organs and faculties with which nature had endowed him in his own body. This being so, we cannot be surprised to find that much, if not all, of that complex equipment of modern society, which is so characteristic of our civilization, possesses this one common feature, that it serves functions analogous to those of certain organs and faculties of human economy. Machines do the work previously performed by the hand, or carry from place to place ourselves and the loads which primitive man had to convey on his own back or that of a patient beast of burden. Again, the telephone, for example, is a highly specialized ear; and the great libraries may be regarded as artificial adjuncts to our memory, and in that sense as our artificial brain. Examples of this kind might be multiplied almost indefinitely. But nowhere, perhaps, is the analogy in function and even in structure more clearly shown than in the photographic camera, which, in its essentials, is a copy of the eye. Yet there are certain differences. In some respects the ordinary camera does more than the eye; in others, less It does more, for it leaves a permanen record of the image formed, while the image upon the retina of the eye persists normally but for a few tenths of a second, and what lasting record there is, takes the form of a mental image or recollection. But this same circumstance which, in one way, works to the advantage of the camera, becomes a drawback when the aim is to record the action of a moving object, for the retina of the eye is, as it were, continuously resensitized and ready at any moment to receive new impressions of the successive positions of the moving object—impressions of which a more or less accurate and permanent record may be treasured in the observer's memory. Here the ordinary camera forsakes us, unless indeed the motion be very slow, in which case a sufficient record of the successive positions of the object might be obtained by making a number of successive exposures. What is possible for a slowly moving object must be equally possible for one moving rapidly. The difficulty is merely a technical one and has been overcome largely by the efforts of Edison, which culminated in the production of the modern cinematograph.

The kinemacolor apparatus in operation.

The rheostat serves to regulate the speed.



Kinemacolor film.

Note the alternate red (R) and green (G) exposures.

This device, however, as designed by Edison, throws on the screen a monochrome reproduction, similar in character to the ordinary black and white photograph. While, owing to a peculiarity of our mind and vision, such a monochrome reproduction, though differing quite obviously in character from the original, satisfies the eye, it is evidently very desirable to go a step farther and represent the moving object in all its natural color.

Color photography has, in our days, developed to a fairly advanced stage, and therefore the problem of applying its principles to moving pictures invites the enterprising inventor.

As a result of efforts in this direction, there is now being exhibited, among other places, in New York city, a most attractive series of colored moving pictures, produced by a special process patented by Messrs. Urban and Smith, and based on the principle of color photography by means of filter screens. It may be well briefly to recall here the nature of this principle, which we owe to the genius of the great Clerk Maxwell, the same who gave us the modern theory of electricity. The process consists in making several exposures of the same object through a number of colored screens. The plates used must be specially sensitized to respond readily to light of all colors. Thus, for example, one exposure is made through a red screen, which transmits chiefly red light. The dia-positive copy prepared from the negative thus obtained will be transparent at points corresponding to the red portions of the original object and will be more or less darkened in other parts. If, therefore, this positive is itself viewed through a red screen it will show high lights of bright red where the object is red, while at other points the red light will be more or less completely cut off. The exposure upon the green screen will give a corresponding result, however with the high lights at those portions from which the object sends out a bright green light. If both positives are now viewed through a green and red screen together, an effect which can be secured by various means, this combination will show red in the red high lights, green in the green high lights, and intermediate colors at other points. By the use of plates of the right sensitiveness and by a proper selection of the color of the screens, it is possible in this way to obtain a more or less exact reproduction of the object in its natural colors, though in ordinary work it is found desirable to use screens of more than two colors.

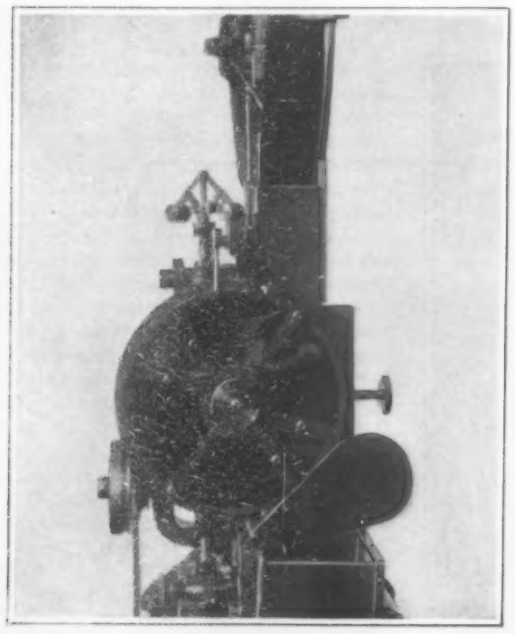
In applying this principle to moving pictures, it is necessary to make alternate exposures behind red and green screens. In practice technical difficulties arise. In the first place, this process requires twice as many exposures per second as the ordinary black and white process. This means that both the camera shutter and the projecting machine must be run at twice the ordinary speed, say, thirty-two pictures per second instead of sixteen. In addition to this, a red and a green screen must be interposed in rapid alternation in the path of the rays of the lantern, and this rapid alternation must keep strict pace with the alternation of the images on the film, in such manner that every time the imag[illegible] red by means of a red screen is in sight, the red screen is in position, and similarly for the green. In practice, this is effected by providing a circular rotating screen having a red and a green sector and revolving in front of the film.

Our illustrations show the general aspect of the kinemacolor projecting lantern as a whole, and certain parts more in detail. The essential point wherein the apparatus differs materially from the ordinary kinematograph lantern is of course the rotating screen, with red and green sectors. This is shown particularly plainly in one of the views of which it forms the central feature. It is also seen in its working position in the general view illustrating the entire apparatus and its stand.

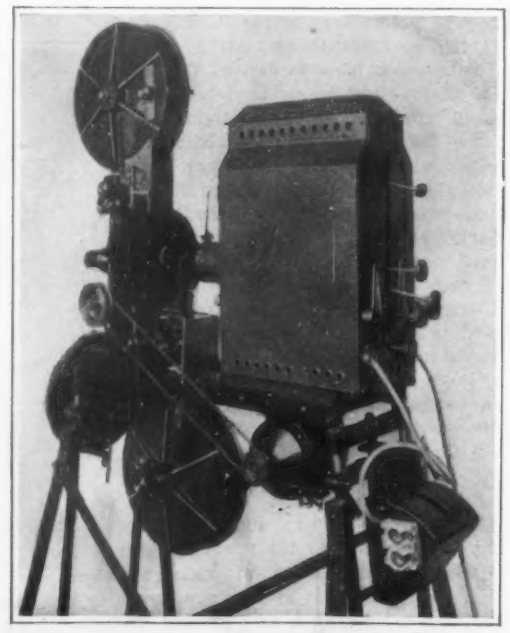
There is no occasion to describe in detail the entire mechanism of the apparatus, as it is essentially similar to that of the ordinary moving picture machine, but for the one feature of the revolving color screen.

As regards the kinemacolor film, its character is well displayed in one of the accompanying illustrations. Alternate pictures (marked *G* and *R* respectively) correspond to exposures through the green and the red screen. Note the red table cloth, which appears dark on the green film and light on the red film. Thus, red light reaches the screen at this point, while the green is cut off.

The Kinemacolor Company is to be congratulated on the very fine display which they are giving at the present time. Especially in some of the still-life studies of flowers the color effects are most excellent. The films of the coronation ceremonies in England, which would be of much interest even in ordinary black and white reproduction, are made still more attractive by the coloration. This, it may incidentally be said, is vastly superior to that of hand colored films. There seems, however, still room for further improvement, as is only natural in so new a departure. The reds tend to be a little too red, the greens too livid a green, and other colors are often rather nondescript and neutral tints. Another slight defect which is sometimes observable on close inspection, is that the whites are fringed with red or green borders. This is presumably due to imperfect overlapping of the red and green pictures. But the effect is very slight, and only noticeable to a close observer. An appearance which is not quite so easily explained is that in certain rapidly moving parts, such as the bright line down the seam of the soldiers' trousers, the image occasionally appears split up, showing simultaneously several positions, with the colors apparently split up also into red and green. But these are slight defects in an otherwise truly remarkable production, and every one who is within ready access of the exhibition should make a point of visiting it.



Near view of the revolving screen with the red and green segments.



General view of the machine. Showing the revolving color screen in position.

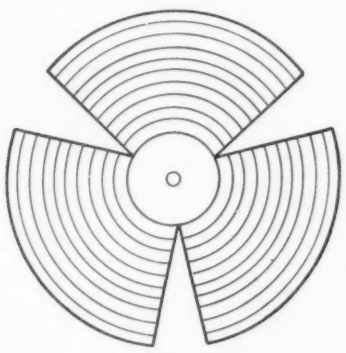
Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

Centering Disk

By William Grotzinger

A HANDY tool for finding quickly the centers of round stock is shown in the illustration. It consists of a sheet-metal disk with a number of circular lines drawn on it and three deep notches cut in it. This disk of course can be made any size, according to



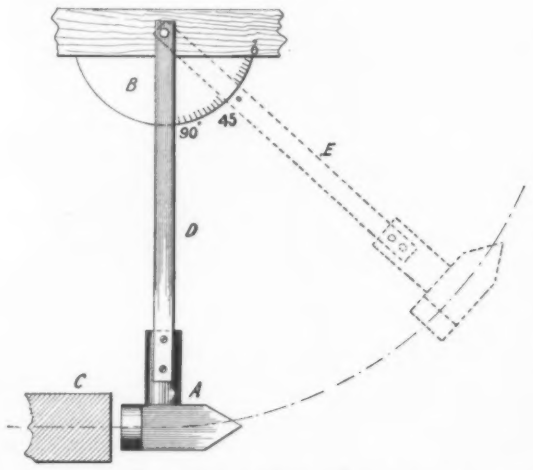
Centering disk.

the work it is to be used for. Simply place it on the end of the stock, move it about until the edge of the piece coincides with the circular lines, as seen through the slots, and then mark the center.

Testing the Hardness of Metals

By B. F. Dashiell

THE amateur who wishes to discover the hardest piece of metal among a number of samples will find the apparatus illustrated herewith suitable for his requirements. Ordinarily a delicate instrument is used for this test. However, for the average amateur's needs the rough instrument here described is sufficiently accurate. It consists of a light riveting hammer *A* secured to a piece of iron rod *D* about three feet



Apparatus for testing the hardness of metals.

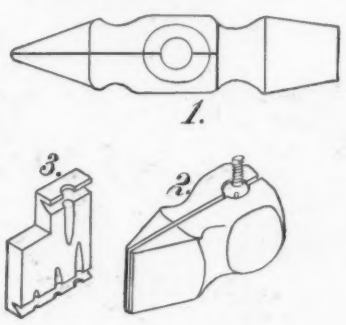
long. A protractor *B* is fastened to a support from which the riveting hammer is suspended. Normally the rod hangs with its edge directly in line with the 90-degree mark of the protractor. The metal to be tested is indicated at *C* and should be held in a vise so that it just touches the riveting hammer. The hammer is then drawn back 45 degrees to the position indicated by dotted line at *E*. On being released it falls against the metal *C* and rebounds. The test piece giving the greatest rebound is the hardest.

Holding a Screw by the Hand

By George W. Colles

IT would be hard to find anyone who works with tools who has not frequently been required to hold a screw or nail by the head while working on the shank; and yet there is no appliance on the market for this purpose. Copper or lead vise-jaws are usually used for this purpose; but they are inefficient where the screw is short and the entire length of the shank has to be free. Pawing over the junk pile, I found the head of an old ten-cent hammer. This was the kind with a conical socket and a screw in the top end to hold the handle in place. After cutting off the round end, and slitting the balance longitudinally as shown by the heavy lines in Fig. 1 (which is a side view from the handle end) I had two jaws, as shown in Fig. 2, which did the business. As the socket is conical, any common size of screw can be held with it. The bottom of the groove should be recessed with a round file.

If you have not an old hammer head like that described, get two pieces of 3/16-inch to a ¼-inch sheet iron or brass about 1 to 1½ inches square. To avoid unnecessary filing, a corner may be cut out. With a half-round file a groove is then filed parallel and close to one edge, and with a rat-tail file a semicircular notch at right angles to this groove. If the screw has a flat head, it is best to have the oblique edge of the

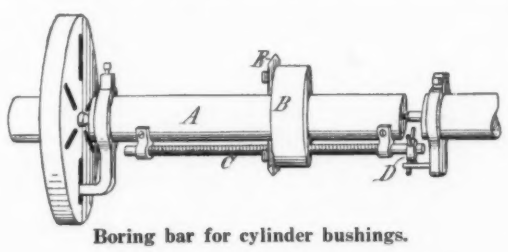


Vises for small screws.

groove next to the edge, and if a round head, on the side away from the edge. A pair of these jaws provided with both kinds of grooves and several sizes of notches as shown in Fig. 3 can be made in a short time, and will eliminate the screw-holding trouble for ever after.

A Boring Bar for Cylinder Bushings

THE accompanying drawing shows a boring bar for large work with which bushings may be bored perfectly true. This boring-bar consists of a heavy bar made of machine steel *A*, upon which there is a stiff traveling head *B*, also made of machine steel. The head *B* is bored to a neat sliding fit over the bar *A*. The head moves longitudinally over the bar and is fed by the screw *C*. At one end of the screw there is a



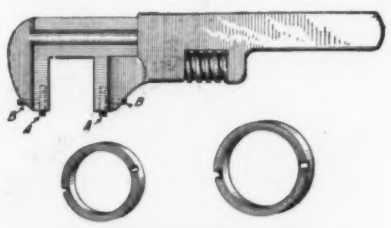
Boring bar for cylinder bushings.

star wheel *D*, by which it is turned. As the bar revolves, one arm strikes against a stop at each revolution. This turns the screw by an amount proportional to the number of arms in the star. For example, if there are six arms in the star, the screw will be turned one-sixth of a revolution for each revolution of the boring bar. As the screw turns, it moves the head along with the tools *E* mounted thereon.

Adjustable Spanner Wrench

By Israel R. Hicks

WHEN assembling machines that have round or spanner nuts in their construction, a number of special wrenches are required. A handy tool under such circumstances is an adjustable spanner wrench, which may be made of a common monkey wrench. Drill a 3/32-inch hole in the end of each jaw to receive a steel pin *A* of the same diameter. Each pin may be held



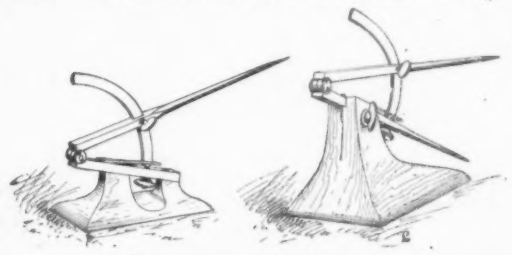
Adjustable spanner wrench.

in place by means of a set screw *B*. The holes for the pins should be as deep as the pins are long, so that when the wrench is not to be used as a spanner, the pins may be dropped in their sockets flush with the ends of the jaws. Thus the wrench is in no way impaired for use in normal service.

A Home-made Surface Gage

By Albert F. Bishop

A SURFACE gage may very simply be made as shown in the drawing. The left-hand figure represents an iron pedestal with an ordinary pair of dividers, fastened on the beveled edge at the top with two machine screws. One leg has been cut off, as shown in the pic-

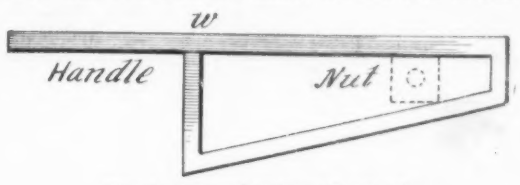


Two simple surface gages.

ture. In the other figure the pedestal is of hard wood beveled off on top and grooved out with a saw cut in the center of the groove, allowing it to clamp the dividers when laid in the groove, on turning up the thumb screw. This simple form will answer for woodwork, pattern making, etc. The dividers can be removed at any time, and are just as good for other work.

Handy Universal Wrench

THE accompanying engraving illustrates a very simple wrench for nuts and bolts of various sizes. It is made of a piece of ¼-inch square iron rod about a foot long. This is heated to a cherry red and then is bent



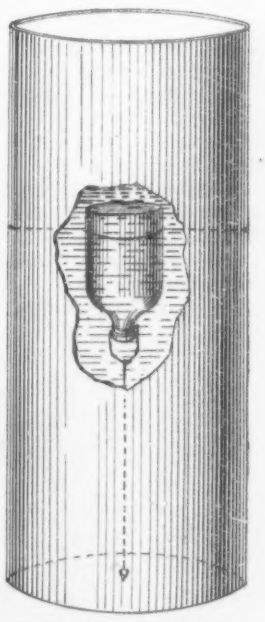
Simple form of universal wrench.

to the shape shown. The wrench may be strengthened by welding it at the joint *w*. The manner of applying the wrench on a bolt head or nut is illustrated clearly, the nut being indicated by dotted lines.

To Keep a Tank from Bursting in Freezing Weather

By Lloyd V. Beets

TO keep a water tank from bursting when freezing up, procure a very large jug, and inverting in the tank fasten it in this position by a wire wrapped around the neck and fastened to an eye in the bottom of the tank. This has been found successful by the writer. The secret lies in the fact that this jug contains air, mostly, and when any extra pressure is put upon the water, this air is compressed, relieving the pressure on the tank.



Preventing a tank from bursting in freezing weather.

Workshop Notes

To Restore Burnt Steel.—To restore burnt tool steel, heat the piece to a red heat, then sprinkle over it a mixture of 8 parts red chromate of potassium, 3 parts saltpeter, ¼ part aloes, ¼ part gum arabic, and ¼ part rosin. Machine tools treated in this way will stand up as well as before they were burned.—C. D. H.

How to Prevent Babbitt Metal from Exploding.—Before pouring babbitt metal, add a piece of rosin about the size of a walnut and allow it to melt. If the bearing to be lined with babbitt is warmed before pouring, the metal will run better and a better job will be had.—H. D. CHAPMAN.

The Inventor's Department

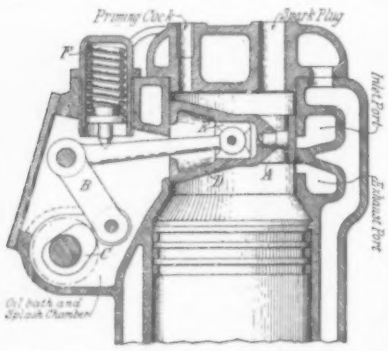
Simple Patent Law; Patent Office News; Inventions New and Interesting

The Split Ring "Valveless" Engine

POPPET valves and noise are so closely associated in internal combustion engines that it is very natural to characterize the new noiseless motors as "valveless." Of course, such engines are in no sense valveless. The valves have not been abolished, but altered in form. In place of the poppet type, rotary or sliding valves are used.

This marks a return to first practice, for one of the first of the practical gas engines employed sliding valves similar to those of the steam engine. The reason for the poppet valve li... ue fact that it offers a very simple method of opening the inlet and exhaust ports wide and suddenly. But this sudden action of the poppet valve is what produces the noise. The bursting of the charge through the valve and the hammering of the valve upon its seat have made it impossible to construct a silent engine of the poppet valve type. In order to adapt the quiet sliding type of valve to the gasoline engine, it has been necessary to modify it, either in form or in operation, so that it will open the ports as abruptly as a poppet valve.

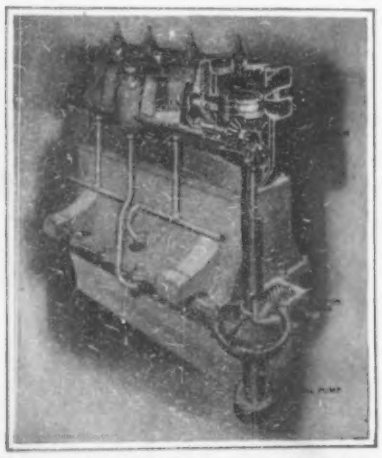
The accompanying illustrations show one of the so-called "valveless" engines, invented in France and now being introduced here, in which the motion of the sliding valve is controlled by a cam. Instead of the rhythmic movement of the steam engine slide valve, this cam produces an irregular motion timed to meet exactly the requirements of the four-cycle, internal combustion engine. This "ring"



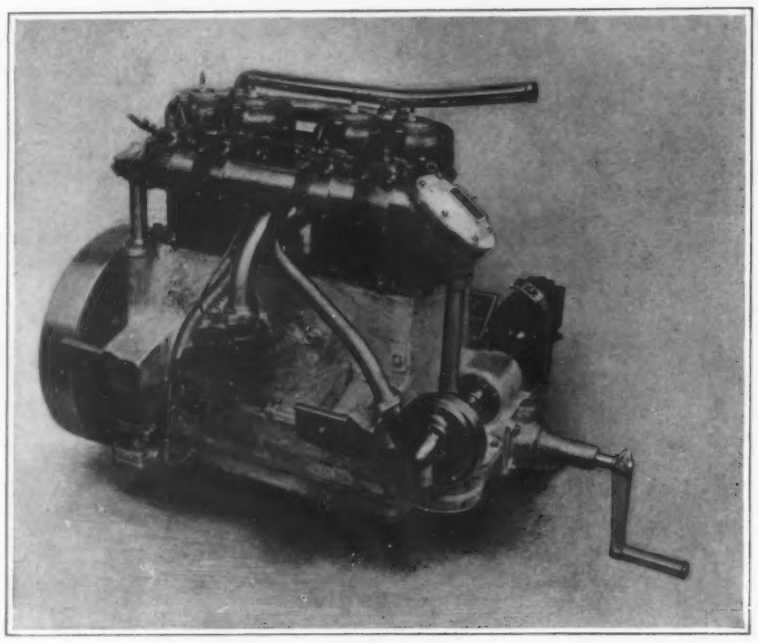
Section showing the position of the valve in the cylinder.

type of valve closely resembles the piston type of steam engine valve, but differs from it in a very important particular, namely, that it requires no stuffing box.

The valve is shown in detail in one of the photographs, and it will be seen that it consists of a split ring. The cylinder of the engine is somewhat reduced in diameter at the upper end, so as to form a valve chamber, indicated clearly in the line sectional drawing. The split ring valve *A* is fitted to slide up and down within the valve chamber, so as to cover and uncover the inlet and outlet ports, indicated at the right-hand side. The motor illustrated herewith is of 100 by 140 millimeters (3.9 by 5.5 inches) bore and stroke. For an engine of this size, the ring has a face of about 1½ inches depth, and it requires a movement of less than one inch to close and open the ports properly. The ring is operated by a bell crank *B* with roller on one arm engaging the cam *C*. The cam shaft is driven by reduced gearing, from the crank shaft of the engine. The bell crank enters a housing *D*, which lies transversely of the ring, and at the inner end the crank arm is fitted with a slide block *E* arranged to slide in ways in the housing. Of course, the motion of the slide is very slight indeed, almost negligible. The slot in the side of the valve chamber through which the bell crank arm passes is sealed by the ring itself, in the same manner that the inlet and outlet ports are closed. It will be observed that the face of the ring at this side is made deeper so as to close the slot at all times. As the ring is split, the expansion of the gases at the period of combustion serves to press it gas tight against the ports, so that there is no danger of leakage, even though no stuffing box or packing of any description is used. As a matter of fact the valve itself is a packing ring.



The engine partly broken away to show the valve gear.



Side view of a four cylinder split-ring "valveless" engine. Note the cam shaft casing in the foreground.

The ports which are opened and closed by the ring have a large area, even greater than the ports of special size used for freak racing automobiles. The valve area of a typical poppet type motor of 3.9 by 5.1 inches bore and stroke is about 1.3 square inches, while the area of the motor here shown is 2.2 square inches. With such wide ports the cylinder is sure to be filled with fresh gases at each suction stroke, and freely scavenged during exhaust. It will be observed that the intake is above the ring, permitting the cool, fresh gases to flow over the housing of the bell crank, while the exhaust port is below the ring, letting the hot gases escape without pouring over the housing. In this way the housing is kept relatively cool, and there is not any danger of overheating the sliding parts within.

The chamber in which the cam is mounted serves as a splash chamber to distribute oil over the bell crank and the slide block. Furthermore, enough oil is spattered upon the ring to make its way between the ring and the cylinder, thus providing ample lubrication. This is a very important feature of the ring type of piston. The difficulties of lubrication have always been considered very serious in motors of the sliding valve type. To return the valve, after it has been raised by the bell crank arm, a spring is used as indicated at *F* in the line drawing. This spring does not have to act against the pressure of the gases in the cylinder, and it does not have to seat the valve, as is the case with springs employed on poppet valves. Hence it may be made comparatively light, with a resultant saving of power.

The motor is being used in several leading European cars and is reported to be giving perfect satisfaction.

Seeing One's Self Talk

A NOVEL instrument was devised not long ago by Prof. John Dutton Wright, of the Wright Oral School for the Deaf in New York City, to enable deaf mutes to examine the operation of their vocal cords when producing sound. The instrument is essentially a Hays' pharyngoscope modified to permit one to look down his own throat. It is shown in use in Fig. 1, and the enlarged Fig. 2 will no doubt give one a better idea of its construction. It consists of a telescope which is doubled back upon itself at a sharp angle, so that the object glass may be placed in the throat or well back in the mouth. At the angle of the telescope there is a prism *A*, which reflects the light as it comes from the object glass *B*. The latter is set at such an angle as to take in the field of the throat. Tiny electric lamps are used to illuminate the region so that the pupil may inspect his vocal organs and study their changes as he varies the pitch of the sound he is producing.

This device should prove of interest not only to teachers of the deaf, but also to physicians, singers and teachers of singers, as well as to other professional users of the voice. We are indebted to the *Laryngoscope* for the accompanying illustrations.

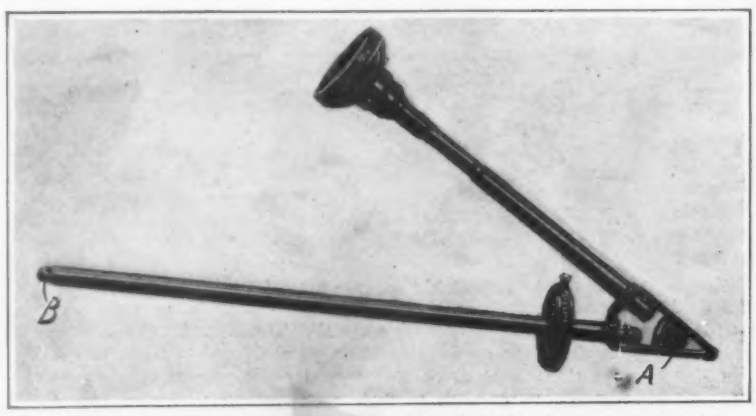
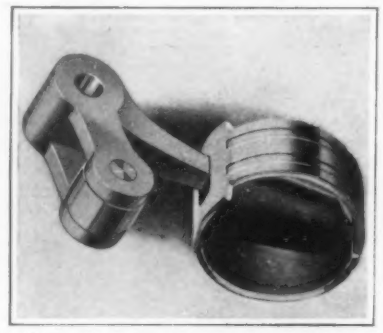


Fig. 2.—Auto-inspection laryngoscope with which deaf mutes are taught to talk.

Fig. 1.—Studying his vocal cords.

Notes for Inventors

Death of Capt. Jorgensen.—Capt. J. C. Jorgensen, one of the inventors of the Krag-Jorgensen rifle, used by the United States army until the new Springfield was adopted, died of heart disease on January 4th in Washington. Capt. Jorgensen was born in Denmark in 1852, and came to this country in 1878. He enlisted in the army and distinguished himself in Indian campaigns. For his meritorious conduct at Fort Wingate, New Mexico, he was voted a medal by Congress and promoted to the grade of sergeant. While in the army he invented the rifle which bears his name.



The split-ring valve and bell-crank.

A Toy Flying Machine.—Lionel A. Carter of St. Louis, assignor to Oscar H. Hyde, trustee, has secured a patent, No. 1,010,585, for a toy flying machine which has a long body and propellers at both ends revolving in opposite directions, but operating to propel the toy in one direction. A pendant weight on a balancing frame can be adjusted back and forth to vary the inclination of the flier.

An Elihu Thomson Rectifier.—Elihu Thomson, assignor to General Electric Company, has patented (No. 1,011,526) a vibrating rectifier wherein are combined a magnet of constant polarity with an air gap between its poles, a body of mercury free to oscillate in the gap, with a source of alternating current connected to the mercury, the oscillations of the mercury under the influence of its alternating field actuating means for delivering alternate impulses of current as unidirectional current. The apparatus comprises a contact making device containing mercury which is forced to vibrate in synchronism with the vibration of the alternating current from which the direct current is to be derived by the mutual reaction of an alternating magnetic field and a field of constant polarity, and the mercury is properly connected to deliver impulses of constant polarity to an external circuit. There is thus provided a simple rectifier that requires no adjustment after it has once been set up and in which there are no springs or other mechanical parts to produce difficulties.

Some Winton Automobile Patents.—Alexander Winton of Cleveland, Ohio, has secured a patent, No. 1,011,693, for a safety starting and igniting mechanism in which a hand controlled ignition lead and the starting mechanism are so arranged that when the starting member is applied, the ignition lead and the hand controlled member therefor are both carried thereby to the position for effecting a later sparking in the cycle of the engine cylinder or cylinders and thus prevent a reverse motion or "kicking back" of the engine; another patent, No. 1,011,695, for a valve operating mechanism, seeking to provide the necessary clearance between the cam operated member and the valve stem in connection with an intervening member which will prevent the noise occasioned by the clearance in valve operating mechanism as heretofore constructed; and two patents, Nos. 1,011,694 and 1,011,696, for carbureters, the former seeking to provide a carbureter by which a proper and uniform mixture is supplied for the very low speed of the engine as well as for the maximum and various intermediate speeds, and the latter has a main carbureting passage for supplying the explosive mixture to the motor when running under load and power and an auxiliary passage for starting the motor and for running it at a low speed.

The Fitch-Rumsey Steamboat Controversy.—Since the publication in our issue of November 11th, 1911, of George Washington's testimonial to Mr. Rumsey's side of the case, our attention has been called to a somewhat extended account of the controversy which may be useful to those interested in the historical phase of the subject and which can be found in the report for 1849, and for 1850, of the Commissioner of Patents. These include an account of the origin of steamboats by Dr. William Thornton, the first superintendent of the Patent Office, published in 1814 and containing some State papers notably something in the nature of a protest of 1810 by William Thornton, and addressed to the Speaker of the House of Representatives of Virginia, protesting against the State granting any patents or exclusive privileges in view of the cession by the State in the Constitution, to the Congress.

Torpedo Nets.—The importance of a weapon may be fairly measured by the attempts to resist it. Three patents, Nos. 1,001,856, 857, and 858 have been granted to Alfred D. Carnagy of Trenton, N. J., assignor to John A. Roebling's Sons, for torpedo nets. The patents relate to the particular arrangements and combinations of the grommets, the grommets in two of the patents being interlaced while in the other patent the grommets of each row and those of successive rows are connected together by links.

New Printing Process.—Consul Benjamin F. Chase of Leeds, in a note from England, refers to a Yorkshire paper which calls attention to the invention of a new process for printing textile fabrics and wall papers. The design is photographically produced, with the aid of a special screen, on a sheet of transparent celluloid. The inventor has, it is stated, succeeded in reproducing photographs on textile fabrics which look much like ordinary photographic prints.

A Composite Arc-light Anode.—Berthold Monasch of Berlin, Germany, assignor to General Electric Company, has patented No. 1,010,942, an arc-light anode of iron having a core of a metal which consumes slower than iron, and specified as an anode of iron with a core of copper.

A Charles Steinmetz Patent.—What is technically described as a method of operating an electric lamp having electrodes affording a plurality of paths for current flow, consisting in deriving from a source of alternating current a plurality of voltages out of phase with each other and impressing these voltages upon respectively different paths in said lamp, the voltages co-operating to produce flow of current in the lamp, has been patented, No. 1,011,088, to Charles P. Steinmetz, assignor to General Electric Company.

Fire Extinguishers.—Edward M. Davidson of New York has secured patents, No. 1,010,869 and 1,010,870, for fire extinguishing compound and process, involving the use of a liquid, carbon tetrachlorid, and a constituent which is thrown down when the compound is heated, as an electrically non-conducting deposit. By the process, the burning material is enveloped with a lingering, cohering blanket of dry combustion-arresting gas, inherently penetrative of the burning materials.

Match-making Patents.—Seven patents, Nos. 1,010,822, 823, 824, 825, 826, 827 and 828, have been granted to Bernard G. Vaughan of Joliet, Ill., assignor to National Match Company of same place, for machines for making and boxing matches.

Rotates a Reciprocating Piston.—In patent No. 1,010,640, George J. Dourte of Longmont, Colorado, shows a crank and a pitman connected with the crank so it will be reciprocated by it. Bevel gears fixed one on the crank wrist and the other on the pitman mesh so that the crank as it turns to reciprocate the pitman, also gives the pitman a rotary movement.

Largest and Smallest Sub-classes.—The largest sub-class of patents made up by the Patent Office at the present time contains two thousand four hundred and eighty-three patents and is known as Sub-class 6, Corn, under Class 111, Seeders and Planters. The title "Corn" of this sub-class containing but one word, is the shortest sub-class title. The smallest sub-class contains but one patent, No. 522,805, and strange to say, rejoices in the distinction of having the longest sub-class title. It is under Class 122, Liquid Heaters and Vaporizers, and the sub-class is 293, known as "Water tube, Rearwardly declined, Over bridge wall, Front and rear header, Horizontal longitudinal drum, Longitudinal water baffle."

A Poetical Patent.—While invention is many times involved in romance, it is not often that rhyme is introduced in patent specifications. In a patent issued September 1st, 1868, for a garden implement termed "The Universal Gardener" with which only one hand is employed, the specification goes on to say: "It is intended to manufacture these beautiful instruments by the million and to furnish them to every household in the United States; and it is fair to conclude that by thus supplying the means of cultivation of useful and beautiful plants, trees, and shrubs, a new love for those

> Floral apostles that in dewy splendor
> Weep without woe and blush without a crime

will be developed, encouraged, stimulated, and that the sum of human happiness will thereby be increased."

Legal Notes

Injunction to Prevent Disclosure of Trade Secrets.—In a suit to enjoin a servant from disclosing trade secrets, consisting of specific methods or secret processes for the manufacture of commercial oxygen, the United States Circuit Court, in S. S. White Dental Manufacturing Company v. Mitchell, 188 Federal Reporter, 1017, holds that it was no objection to the issuance of an injunction that plaintiff failed to point out any specific methods or secret processes which it was proposed to enjoin defendant from disclosing, since the general provision of the order prohibiting action in violation of defendant's contract of employment would be no more indefinite than was the threatened injury, and, if the injunction was enforceable at all, it would be enforceable as well against any disclosure as against any particular process or device. Where the servant terminated his contract and took employment with another concern in the same line of business, but denied that he intended to violate his contract, the court holds that an injunction restraining him from violating it would not be granted as a threat, since he was as much bound by his contract not to disclose after taking up his new employment as before.

The Copyright Situation.—Nothing has done more to clarify and define the practice under the Copyright Law of 1909 than the Rules for Practice and Procedure in the case of infringement of copyright promulgated by the Supreme Court of the United States, and printed by the Copyright Office as Circular No. 20; the eight opinions of the Attorney-General of the United States rendered at intervals from November 17th, 1909, to May 2nd, 1910, and the opinions of January 9th, 1911, and May 6th, 1911, and the adjudicated cases under the 1909 law. These cases are those of Green et al. v. Luby, and White-Smith Publishing Company v. Goff et al. The former case decided that a sketch consisting of a series of recitations and songs with a very little dialogue and action and with scenery and lights thrown upon the singer is a dramatic composition within the provisions of the Copyright Law. Also that the classification of a dramatico-musical composition as a dramatic composition does not affect the validity of the copyright. Also that where one sings an entire copyrighted song with musical accompaniment she is guilty of infringement though she purports merely to mimic another. In the White-Smith Music Publishing case, it was held that the right to renewal of copyrights is limited to the persons named in the Act and does not extend to the "proprietor" of the work although both under the present and prior statutes an original copyright might be secured by such proprietor.

Adjudicated Patents.—Out of sixteen patents recently adjudicated in the Federal Circuit Courts, only two patents were held void, and these were so held for lack of invention in view of the prior art. Of the remaining cases, seven patents in suit were held to be infringed and three patents were held not infringed.

Guaranteeing to Secure Patent.—Patent practitioners are frequently asked whether they will guarantee to procure a patent, by those who do not know that such a guarantee is against the rules of the United States Patent Office. Section *d* of Amended Rule 22 of the Rules of Practice provides:

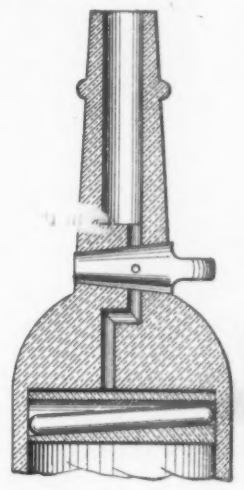
"The Secretary of the Interior may, after notice and opportunity for a hearing, suspend or exclude from further practice before the Patent Office any person, firm, corporation, or association shown to be incompetent, disreputable, or who refuses to comply with the rules and regulations thereof, or who shall, with intent to defraud, in any manner deceive, mislead, or threaten any claimant or prospective claimant, by word, circular, letter, or by advertisement, or by guaranteeing therein the successful prosecution of any application for patent or the procurement of any patent, or which word, circular, letter, or advertisement shall contain therein any false promise or misleading representation."
(Sec. 5, act approved July 4th, 1884.)

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Of General Interest.

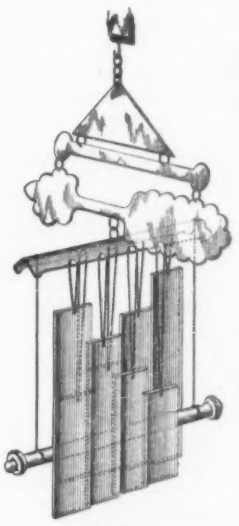
NON-REFILLABLE BOTTLE.—W. W. CLARK, care of Auditor's Office, Panama R. R. Co., Colon, Panama. In this invention the design is to prevent the refilling of the vessel after the original contents have been decanted. The purpose of the improvement is to



NON-REFILLABLE BOTTLE.

provide novel features of construction for a device which will positively seal the bottle against applied pressure in case an attempt is made to refill the same by use of a force pump. The bottle is designed to receive and hold liquids of any density. The engraving herewith represents a longitudinal sectional view showing the bottle emptied and parts adjusted to seal the inlet to the bottle against the introduction of liquid.

CHIME.—H. B. KELLER, 714 Marston Street, Philadelphia, Pa. The aim here is to provide a chime with a vane and a series of plates suspended at right angles to the vane, so that the plates will be disposed at all times at an angle to the direction of the wind. Another



CHIME.

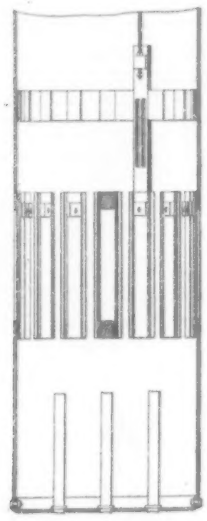
object of the inventor is to provide a plurality of plates which are so graduated in size (see the accompanying illustration) that they will produce the tones representing the notes of an octave, the plates being flat and lapping one another in two series, with a bar suspended between the two series of plates.

BABY HOLDER.—C. M. PRATHER, 2018 Colfax Street, Evanston, Ill. Among the principal objects which the present invention has in view are: To provide a holder for an infant which may be adjusted to accommodate the needs for the same in the sleeping and sitting postures, and to provide a construction which is efficient and readily transported. To afford the infant the necessary air a door and cover are provided with air perforations.

FISH SCREEN.—J. C. AITKEN, Woodville, Ore. This screen can be used with water conduits of different kinds to prevent fish or the like from passing along the conduits. It is self-cleaning and thereby prevents the accumulation of floating and other debris at the screen, which does not hinder the free flow of water along the conduit, and is easily accessible for purposes of replacement or repair.

WELL STRAINER.—D. D. JAMES, Box 147, Mattoon, Ill. This invention relates to a new form of well strainer and casing and more particularly to that class which are adapted to

be sunk into sand strata, to collect the subterraneous water. An object of the inventor is to provide a casing which may be sunk into the ground, said casing having closed port



WELL STRAINER.

closures, which may be replaced by an improved form of screen. He attains the above outlined object by constructing a metallic cylinder having elongated ports in the side adjacent the lower end, which ports are first closed by solid gates, which gates are replaced by gates in the form of strainers. The illustration gives a vertical sectional view showing the lower end of the casing.

Of Interest to Farmers.

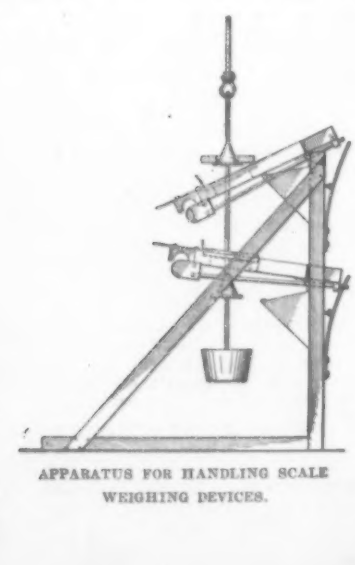
FERTILIZER.—A. A. FORBES, East First Street, North Vancouver, British Columbia, Canada. The object here is to provide a fertilizer containing fish or fish refuse as a base, whereby the fertilizer can be cheaply manufactured without requiring expensive machinery, and the product without offensive odor common to fish guanos, and of high quality on account of the retention of fish oils in the base, and the chemical changing of the oils into soaps and other alkaline substances carrying organic nitrogen of the oils, the fertilizer not being subject to spontaneous combustion.

MOTOR DRIVEN AGRICULTURAL APPARATUS.—A. E. COOK, care of International Motor Plow Co., Odebolt, Iowa, and S. E. KURTZ, Odebolt, Iowa. This invention relates to improvements over the prior patent to Mr. Kurtz, Serial No. 781,214, and the prior patent of Messrs. Cook and Kurtz, Serial No. 781,214, and the prior patent of Messrs. Cook and Kurtz, Serial No. 789,528, disclosing machines in which an engine is mounted on the frame of the apparatus and geared with peculiarly arranged combined cultivating and propelling tools supporting the apparatus, cultivating the earth, and propelling the apparatus over the same.

Hardware and Tools.

ADJUSTABLE HOLDER FOR CHALK AND OTHER MARKING SUBSTANCES.—EMILY C. BALE, The Girls' School, The Acre, Windsor, England. This device is particularly designed for use in schools and for lecturing and the like purposes in which blackboards are used, but it must be understood that the invention is applicable for use in other places where a number of parallel lines are to be drawn and pencils or other marking instruments can be used in place of the chalk. The improvement is an expansible and contractable lattice work having attached to it a number of chalk holders.

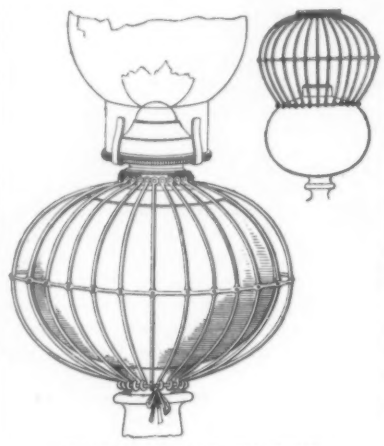
APPARATUS FOR HANDLING SCALE WEIGHING DEVICES.—A. F. CONANT, Littleton, Mass. The illustration of this weighing device represents a side view of an apparatus for handling scale weighing devices of weighing scales shown in conjunction with the steelyard of the scales, and showing the parts in position after having delivered the weighing devices upon the steelyard. The invention provides means for placing and removing weighing devices from scale beams during the operation of weighing; provides means for placing weighing devices of various weights upon the scale beam; and provides an auxiliary device disposed to receive a plurality of weighing devices of different magnitudes.



APPARATUS FOR HANDLING SCALE WEIGHING DEVICES.

Heating and Lighting.

ATTACHABLE LAMP PROTECTOR.—D. T. SINGLETON, Willard, Ga. This invention pertains generally to an attachment for use on fluid burning lamps and more particularly it refers to a simple and effective means which may be quickly attached to a lamp whereby the oil containing receptacle, which is generally made of glass, may be protected against



ATTACHABLE LAMP PROTECTOR.

breakage and the danger resulting in an explosion of the lamp. The larger of the accompanying engravings shows a side view of a table lamp provided with the protector, while the smaller one is a side view of a lamp in position for placing the protector thereon. To attach: remove the burner. Press the ribs down over the neck of, and around the globe of the lamp—tie the ends with cord at the base of the globe. To detach: untie the cord, lift up and off. The "Protector" can be manufactured in many simple forms, very cheaply, and of different and lighter materials.

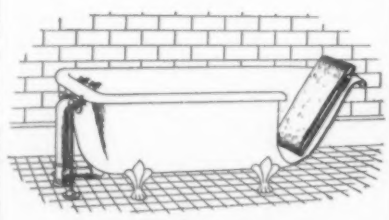
CLOCK CONTROLLED SWITCH.—A. K. WHITE, 613 D Street, Marysville, Cal. This switch is designed for automatically turning on and off at predetermined times the electric lamps used in show windows or other places, or turning the lamps on at the beginning of dusk and off at midnight, or, if desired, turning on a series of lamps at the beginning of dusk, turning off the lamps at midnight, and turning on a single lamp during the remainder of the night.

SUPERHEATER.—S. MUNSON, Fowler, Col. The invention has for its object to improve the constructions shown in prior patents granted to Mr. Munson, by providing the superheater coils in sections, which are secured together, thus lessening the cost of construction, the coils being also so constructed that the steam will be heated more quickly than in the previous constructions. Supports are provided for the superheater and coils which will permit of their expansion and contraction.

FURNACE HOOD.—J. C. TREMOULET, 6101 Dauphine Street, New Orleans, La. Mr. Tremoulet's invention comprises a furnace hood adapted for use in the ordinary charcoal-burning furnace and the object of the invention is to provide an improved and simplified structure, at a low cost, which will be efficient in its use. The different parts of the device may be conveniently stamped up from sheet metal.

Household Utilities.

BATH ACCESSORY.—F. HESS, 511 Fifth Avenue, West, Kalispell, Mont. The engraving herewith is a perspective view of a bath tub of usual construction having attached



BATH ACCESSORY.

thereto a back washing accessory constructed and arranged in accordance with the invention. The improvement provides a towel supporting frame arranged to be readily adjusted to a bath tub, the said frame being provided with means for securing the towel firmly in the frame; provides a device adapted for attachment to the inclined end of the bath tub. The towel is stretched over the ends of the frame, and the turn buckles are manipulated to draw the loops upon the ends of the towel to hold it firmly in position. The invention also comprises sanitary features.

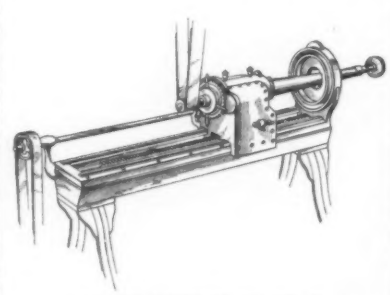
IRONING BOARD.—A. M. SPRINGER, 1326 Macadam Road, Portland, Ore. This invention is an improvement on the Patent No. 868,500 granted to Mr. Springer. In the present invention the object is to simplify the folding operation of the supporting members and to reduce the number of points at which the parts are detachably secured together. Both the inclined and bottom braces are permanently pivoted to the vertical legs and in folding the table, it is only necessary to separate the upper end of the braces from the under side of the table.

CONVERTIBLE BED AND DAVENPORT.—L. B. JEFFCOTT, 250 West 15th Street, New York, N. Y. Use is here made of a main frame, a slidable support to slide between the sides of the main frame, a bed frame formed of sections pivotally connected with one another, the rear section having a link connecting with the main frame and slidable support, the middle bed-frame section having a link connection with said support, and being also pivoted on the support, and the bed-frame section having a link connection with the link of the middle bed-frame section.

Machines and Mechanical Devices.

CALCULATING MACHINE.—V. VOGEL, Riga, Russia. This invention relates more particularly to machines having an indicating device, and a spiral member operatively connected with the same and constituting the actuating agency for the indicating device, the spiral member being adapted to be actuated by a member movable in the direction of the spiral member and in engagement therewith, means being provided for guiding the member which is used to operate the spiral member.

CYLINDER GRINDING MACHINE.—E. STONE and W. STONE, 3510 South Wood Street, Chicago, Ill. This invention, illustrated herewith, relates to grinding mechanism for grinding and dressing the interior surfaces of hollow cylindrical bodies, such as engine cylinders



CYLINDER GRINDING MACHINE.

and the like; and has for its object to provide a means whereby the work may be accomplished with the greatest facility and accuracy. One of the important features is the orbital movement, and in practical working it will be understood that the diameter of the circle described gradually grows less from the grinding-wheel to the vanishing point at the rear end of the grinding-wheel shaft which occupies practically a fixed center. Thus the movement must always be positive and the grinding-wheel made to travel in the path of a true circle and doing the work accurately with all mechanical precision. The patent in this instance is for sale.

BUTTER MOLDING MACHINE.—J. N. JACOBSEN, 1015 54th Street, Oakland, Cal. This machine has a cutter device mounted on a frame in which a shaft is journaled, there being a second frame movable relatively to the first named, in which the butter may be packed to be cooled, there being means for storing the butter in a series of layers on the second-named frame, the butter in each layer being disposed on slats dropped at the end of the second-named frame, when a block provides for conveying the slats and butter in the direction of the cutter. This block is detachably connected with sprocket chains which travel on wheels on a shaft disposed in open bearings in the last named frame, and on sprocket wheels on the first named shaft.

AEROPLANE.—M. KALABA, 29 Cottage Place, New Rochelle, N. Y. The purpose here is to provide improvements whereby balance or stability is obtained, the lifting power increased, and in accident to the motor or other parts the aeroplane is readily sustained in the air. For the purpose named use is made of inflatable bags mounted on the aeroplane and connected with means under the control of the aviator for inflating the bags wholly or partly according to circumstances.

MACHINE FOR INSERTING DIAGONAL STRANDS IN WOVEN CANE FABRICS.—M. B. ZIMMERMAN, care of A. D. HOUSE, Lewisburg, Pa. This machine provides for depressing the warp strands and raising the weft strands in woven cane fabric for the passage of a needle carrying a diagonal strand, and accomplishes this by the joint downward movement of a bar carrying depressing fingers for the warp strands in connection with automatically-acting fingers that receive and hold elevated the weft strands.

ATTACHMENT FOR LATHES.—A. M. ROBERTS, 127 Clinton Street, Greenville, Pa. This invention has reference to attachments for lathes, and the aim is to provide one with an arm adapted to be engaged by adjustable blocks on the face plate of the lathe, for rocking a shaft which is connected for moving the slide rest of the lathe, on the carriage of which it is mounted.

BRAKE LEVER.—E. E. KUEHL, Verdigris, Neb. This is an improvement in levers, and especially in brake levers designed for use in connection with any suitable brake mechanism. The engraving shows a detail side view of a brake mechanism embodying the invention. A segment rack and a brake lever are provided, the latter having a main portion and a handle portion. The main portion is pivoted at the

BRAKE LEVER.

bottom of the device and the handle is pivoted to the main portion and is provided below this pivot with a slot into which projects a pin which limits the rocking of the handle. The segment is provided with teeth or notches disposed along the upper and lower edges as shown. The teeth are blunted to prevent injury to their upper ends by the point of the dog as the latter is moved forcibly back over the teeth from right to left end of the rack. A pendant at the point prevents the dog from jumping teeth as it moves.

CENTRIFUGAL MACHINE.—E. ROBERTS and A. H. GIBSON, Lehi, Utah. The object of the invention is to provide a machine wherein a means is provided for thoroughly cleaning the inner surface of the basket, which may be swung over the basket, lowered thereinto, and withdrawn and swing away from over the basket after the basket is cleaned.

FLYING MACHINE.—E. W. F. HERRMANN, 314 Paso Hondo Street, San Antonio, Texas. Certain features of this machine, such as the central opening and the front and rear dihedral angles, all go to make up a supporting plane which is automatically stable in itself, and will control the equilibrium and steering thereof. The invention provides a supporting plane capable of being warped at various points, so as to control ascension and descension, and also to control the lateral equilibrium and steering thereof.

CLUTCH FOR STUMP PULLERS.—J. C. WILLIAMSON, Dexter, Ga. This invention is an improvement in clutches for that class of stump-pullers in which a cable is wound on a rotatable drum having a sweep or long lever to which a team may be hitched. The qualities most desired in such machines are maximum lightness, strength and power with adaptation for convenient and practically instantaneous locking or release of the winding drum with relation to the sweep shaft.

Prime Movers and Their Accessories.

INTERNAL COMBUSTION ENGINE.—A. H. FORSYTHE, care of Reynold Carriage and Manufacturing Company, 311 East Third Street, Joplin, Mo. The more particular purpose in this case is to provide an engine having a plurality of cylinders connected with a chest, the last containing a rotating plug which takes care of the explosive charges admitted to the cylinders and also of the burned gases discharged from the cylinders after the various explosions.

Pertaining to Recreation.

RACE GAME APPARATUS.—R. M. BRENNER, Room 5, 1440 Broadway, New York, N. Y. The intention in this instance is to provide a race game apparatus more especially designed for use in pleasure resorts, exhibitions and other places, and arranged to simulate a horse race or a similar race in all its stages, and one which is exceedingly interesting and amusing to the onlookers.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

INQUIRY COLUMN

Inquiry No. 9247.—Wanted, to buy a Parmelee aerated water.

Inquiry No. 9254.—Wanted, the name and address of manufacturers of lead pencils and pen holders, such as are used for printing advertisements on.

Inquiry No. 9255.—Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be cheap and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as anabrasive.

Inquiry No. 9261.—Wanted, a manufacturer to make card games

Inquiry No. 9262.—Wanted, to buy a glass which is a conductor of electricity, and the address of the makers of the same.

Frost Flowers and Snow Crystals

(Concluded from page 64.)

opportunity to lose their heat until the resultant temperature is below freezing point, and yet not freeze. The sides of the pool are ragged or rushgrown; weeds and rushes break the surface, growing up from below; and the motion of the surrounding atmosphere, or vibrations in the earth, agitate the liquid.

If we sit down to watch a pool on a frosty night, we shall see some such process occur as this: Let us suppose that the bulb of a thermometer is suspended in the water in such a manner that the movements of the mercury column are visible to our eyes. The column falls gradually until it reaches the point marked freezing, 32 degrees on the Fahrenheit scale. There it will probably remain for a while. Presently we shall notice that a light film appears around the edges of the pool, or where a weed breaks the surface. This film extends and visibly increases in cohesion and thickness. Patches of it appear all about the surface of the pool. If the night is very still we may even hear a faint sound as of crackling, as the young ice spreads and grows, and the edges of contiguous patches infringe. Now the thermometer registers a quick fall, to 24 degrees perhaps. At first the ice film almost wore the appearance of a dirty slush, as though one cast a handful of snow into the water. Now it becomes a clean, firm, and polished covering—ice in fact.

We have seen the surface of a pool assume the solid form of ice; and that this ice grew outward from the banks or from around such solid substances as floated on the surface of the pool or broke it by growing up from below. We have even heard the young ice crackle as it grew. To learn what has happened we must leave the pool and search for the opportunity of obtaining another object lesson.

Let us suppose that we are standing on the ice which covers a mountain lake. It is midwinter and this ice is several feet thick. There is no snow upon it and the sun, falling upon the ice, shows us that its substance is full of what wears the appearance of gleaming white spots. Assuming that the light and other conditions are favorable for the observation, we can now learn how ice melts. Each of these spots is the center of a liquid six-petaled flower, and the central gleaming spot is a vacuum. All such flowers lie parallel to the surface of freezing. They are never confused or imperfect unless the structure of the ice be faulty. They tell us what ice is.

When a sheet of water, such as a lake, begins to freeze, six-rayed ice-stars are formed here and there, and float on the surface. These touch each other and their edges join. They are the component parts of the sludgy film which grows outward from the banks of a freezing pool, and, later on, it is these six-rayed crystals which are compressed together by the sheer force of their own expansion and growth to form transparent sheets of ice. The sheets float on water because each molecule of water expands as it is transformed into the crystalline form-ice. Contrariwise, when the sun's rays reverse the process, and melt an ice star in the heart of a block of ice, but so delicately as not to destroy the specific form of the melted crystal, this water-flower occupies a less space than the original ice-flower, and its petals are arranged around the gleaming spots of vacuum mentioned above.

Floating ice-crystals, or free water-flowers in ice, can only be observed *in situ*, and rarely then. Few speculations cause one greater wonder than a deliberate consideration of what must be the almost-incredible power exerted by the rays of these unstable ice-stars to weld them into that ice which will bear the weight of a man, or split asunder huge rocks. Skaters may occasionally have ocular proof of the reality of this power, as when the ice-covering of a lake "bends-up" with a report like that of a small cannon—an incident due solely to the intolerable lateral and upward strains on the mass when the ice-sheet stretches from shore to shore and is still "growing" downward into the depths of water. The expanding ice must force the lake banks apart, force out the bed of the lake, or heave itself bodily upward. The last alternative encounters the least resistance, and hence those cracks and ridges on the ice which

bring many a nasty fall to the skater.

Ice is the solid form assumed by liquid terrestrial waters in the process of congelation or freezing. When what may for the moment be called liquid aerial water-rain, freezes, we get hail-stones. But the water held in suspense by the atmosphere surrounding our earth is held in the form of vapor. Saturation of the atmosphere with water-vapor is followed by condensation. This vapor in its condensed form, becomes too heavy to be supported by the atmosphere which forthwith lets it fall back to earth whence it was before, and will again be taken up through the incessant evaporation. Deposits of condensed atmospheric vapor occur in various forms and from various causes. When a warm vapor saturated area of our atmosphere is suduenly cooled by contact with colder air-currents, or other causes, it undergoes condensation and lets its liquid burden fall back to earth as rain, hail or snow. When a saturated section of the lower atmosphere comes in contact with a section of earth at a lower temperature, as during a summer night the surplus moisture in this air falls as dew; in winter as hoar frost; under conditions which are far rarer and seldom occur except locally, in high mountain districts in early winter, the deposit takes the form of frost-flowers. These frost-flowers are identical in form with those other flowers, called snow flakes, which are formed "in the clouds" or yet again the ice-flowers which, welded together by their natural expansion, cover pools of water with a sheet of ice in frosty weather—as already described. The white deposit of hoar-frost is also built of them. All invariably come into existence as six-sided stars. There is no other type, but this type apart, the forms are of an infinite variety: over 1,000 have been enumerated.

It is hardly possible to photograph those ice-stars, the birth of which precedes the change of liquid water into solid ice. To photograph snow-flakes is, again, not easy. The pictures accompanying this article are therefore all reproduced from photographs of ice-flowers or natural objects coated with hoar-frost.

The Romance of Echoes

(Concluded from page 69.)

the left; now in unison with the direct sound, and presently a third, fifth, or tenth of the fundamental. Occasionally it seems to combine two or more voices in harmony, but more frequently it resembles the voice of a single mimic."

Brewer also tells us that the celebrated echo of the Gap of Dunloe, in the lakes of Killarney, will render an excellent *second* to a simple air played on a bugle. This is merely an embroidered version of the true story, which is that if the bugler chooses the right station and plays in the right tempo, the reflected notes will be heard at the same instant with different notes of the direct air, and may harmonize with them in many cases. This does not appear to be a true case of harmonic echo. An unmistakable case was, however, reported by Rayleigh himself, viz., that of the echo at Bedgebury Park, the country residence of Mr. Beresford Hope. The sound of a woman's voice was returned from a plantation of firs, situated across a valley, with the pitch *raised an octave*. The original sound required to be loud and rather high, and a man's voice would not produce the effect.

Rayleigh explained these echoes on the principle of selective reflection. Just as small particles in the air will reflect light of short wave-lengths, but not that of long wave-lengths—a fact that explains the colors of the sky—so obstacles that are small in proportion to the length of the sound-waves will reflect only the smaller sound-waves; i. e., those of high pitch. Thus, in the case of a composite note, such as that proceeding from the human throat, a group of small obstacles will return high-pitched overtones, or harmonics, but not the fundamental.

Lastly, we come to aerial echoes; i. e., sounds reflected not by solid obstacles but by invisible acustic clouds in the atmosphere. Once upon a time it was believed that ordinary clouds, visible aggregations of water-drops, were potent reflectors of sound; and that, similarly, a fog obstructed the passage of sound. These notions were effectually dispelled by Tyndall, as a result of his experiments with fog signals, in 1873. Tyndall found on the other hand, that the sounds of syrens and signal-guns were reflected by the atmosphere even in the clearest weather. He explained this effect as due to a flocculent condition of the air arising from unequal heating or moisture.

The latest episode in the romance of echoes—and one of the most romantic—has to do with aerial reflections on a vast scale, and it is especially noteworthy for the reason that it has suggested to meteorologists a novel method of investigating regions of the upper air that are far beyond the reach of kites and balloons.

On November 15th, 1908, a magazine containing some 28 tons of dynamite exploded in a tunnel of the Jungfrau railway. The detonation was heard over a zone extending to the north and northeast for a distance of about 30 kilometers (the configuration of the mountain preventing the propagation of the sound in other directions). Beyond this zone no sound whatever was heard over a region some 100 kilometers wide, embracing the northern half of Switzerland. Yet, strange to say, over a wide region beginning near the northern border of the country and extending north into Germany the sound was heard. In other words, there was a zone of normal audibility, then a wide zone of silence, and then a zone of abnormal audibility, beginning about 140 kilometers from the place of the explosion and ending about 50 kilometers farther away. These facts were fully established by the Swiss Meteorological Institute, which took pains to collect reports from all parts of Switzerland and southern Germany, and published a map showing the places from which positive and negative information was received. Moreover, the same curious acoustic phenomenon had been observed in connection with certain explosions in Germany a few years before.

How is this effect explained? Making due allowance for the acoustic shadows of the mountains, and for the refraction of sound due to vertical variations of wind and temperature, we must still seek an adequate explanation of the fact that the sound of the explosion jumped completely over a region 100 kilometers in diameter, and, after pursuing a path through the air above the level of certain mountain observatories (from which negative reports were received) returned to earth again. This looks like a case of aerial reflection, and we must seek its cause.

In his recent studies on the stratification of the atmosphere[1] Dr. Alfred Wegener offers the following explanation: The atmosphere is rather abruptly divided at an altitude of about 70 kilometers by the boundary plane between a stratum consisting chiefly of nitrogen, and one consisting chiefly of hydrogen. The speed of sound is many times greater in the latter gas than in the former. Hence a sound-wave impinging on this boundary plane at a sufficiently great angle of incidence would undergo total reflection. If the plane of separation were sharply defined, and if no other causes conspired to deflect the path of the sound, it would, when propagated upward from the earth's surface, return to the ground at and beyond a distance of 40 kilometers from its place of origin. These conditions, however, are not fulfilled, for the path is in the first place deflected by the ordinary causes of acoustic refraction, and in the second place it does not encounter a sharp plane of demarcation between the two gases. Taking these facts into account, Wegener finds that the path of the sound is a gradual curve, the crest of which varies in altitude with the angle at which the sound leaves its origin. According to his calculation the nearest point at which the sound should return to the earth is 116 kilometers.

Why not, asks Wegener, reproduce the Jungfrau explosion experimentally? With a widespread corps of observers on the alert to note results at a prearranged moment, a much less powerful and less costly explosion would suffice to send a message forty-odd miles above the earth and back again. The suggestion is worthy of the attention of meteorolgists, for no means should be neglected that may lead to precise knowledge concerning the, at present, decidedly problematical structure of the atmosphere above the level where it ceases to be *air*.—C. F. T.

[1] Physikalische Zeitschrift, March 1, 1911.

Tribute from a Leading London Daily

THE *Daily Telegraph* of London has this to say of our recent issue on the United States Navy:

"A naval number of the SCIENTIFIC AMERICAN, the leading weekly paper on its particular plane in the United States, has just been published. Such a production is only possible on the other side of the Atlantic, for everyone concerned in naval administration in the United States, from President Taft downward, has co-operated to make this issue a notable event in naval literature. The beautiful cover, in colors, bears a message from Mr. Taft, and within are a number of articles of peculiar interest.

"From that of Rear-Admiral Mahan quotations are made in another column. Mr. Meyer, the Secretary of the Navy, writes on 'The Business Management of the Navy;' Rear-Admiral R. Wainwright, one of the staff officers, gives some reasons for believing that the American navy has reached a higher standard of readiness for service; Rear-Admiral H. I. Cone, engineer and chief, contributes an interesting article on 'Propelling Machinery for Naval Vessels;' and Rear-Admiral N. C. Twining, chief of the Bureau of Ordnance, describes recent developments in gun manufacture. These are only a few of the articles—all written by the chief expert authorities of the American fleet. The issue is admirably illustrated, and is a remarkable contribution to naval literature."

How Far May Thunder be Heard

CHAMBERS'S ENCYCLOPÆDIA, in its article on "Lightning," says: "The distance away of the flash can be estimated by the time between flash and the beginning of the thunder, every 5 seconds being equivalent to 1 mile; 50 seconds or 10 miles is the greatest observed interval at which thunder has been heard." Other reference books say 15 miles; and this is, we believe, the prevailing popular opinion. It nearly agrees with, and is probably founded upon, the statement in Arago's well-known work on thunder and lightning—the highest authority of its time—that De l'Isle once counted 72 seconds between the lightning and the thunder. This, says Arago, is the greatest interval recorded in the annals of meteorology, and is 23 seconds greater than in any other case with which he was acquainted.

It is rather rare that the case that the flashes in a distant thunderstorm are so spaced that one can tell certainly to which flash a particular peal of thunder belongs: hence the difficulty of testing the above figures. Such an opportunity was, however, recently presented to a well-known German meteorologist, Dr. R. Hennig, while he was visiting a summer resort on the Baltic. From his bed one night he observed the flashes of a thunderstorm far out at sea at intervals of several minutes. The thunder was faint, but distinctly audible. On "counting seconds" he found that from eighty to ninety seconds and upward elapsed between lightning and thunder. The maximum interval was 96 seconds.

Commenting on this observation, the editor of the *Meteorologische Zeitschrift* states that in northern Germany intervals of from 80 to 85 seconds between lightning and thunder have frequently been recorded. On the coast, with an abnormal distribution of atmospheric density, much greater intervals are sometimes observed. At Norden, in East Friesland, C. Veneema has on several occasions noted intervals as great as 140 seconds. At ordinary temperatures of the air this would correspond to a distance of about 29 miles. In one case this observer believed the interval to have been 310 seconds, representing a distance of about 65 miles.

The Largest University in the World

A NOTE was published in the SCIENTIFIC AMERICAN of December 30th, 1911, claiming that Columbia with a total enrollment of nearly 8,000 is the largest university in the world. This statement has been corrected by a Columbia man in *Science*. According to his figures, without considering Asiatic universities, the University of Paris heads the list with 17,000 students after which follow Cairo with 10,000; Berlin, 9,600; Moscow, 9,000, and St. Petersburg, 9,000.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12591) S. S. asks: I would like to know if we have any kind of insulating materials for a magnet? A. There is no insulating material for magnetic lines. They pass through everything. The only mode of protecting a magnetic needle from outside magnetism is to place it in an iron box, which furnishes an easier way for the magnetic lines than the air in the box, and so they pass around the magnet and do not emerge into the air within the box and affect the magnet therein. Such an arrangement is a magnetic screen, but not an insulator.

(12592) L. L. L. asks: 1 How far will an object sink in the deepest known ocean, and how heavy would the weight have to be? Would shape of sinker be any advantage? A. Any weight which will sink in sea water will go to the bottom of the ocean before it stops. The reason is that sea water is only 1/20 denser at the bottom than it is at the surface of the ocean, while any weight will be compressed more by the water than the water is at the lowest deeps of the ocean. The shape of a sinker will not make much difference. A spherical sinker will have the least surface for its weight, and will not be so liable to deviation as it sinks as some other forms. 2. Is it possible at the present time to make a cable that would stand the strain necessary to lower said weight to the bottom, including the weight of cable? A. The ocean is sounded by the use of a steel wire. The sinker pulls the wire down. When the sinker strikes the bottom it is detached, and the wire draws the part which held the sinker up again. The sinker is not recovered. 3. How deep has the ocean been sounded? A. The ocean has been sounded to the bottom in the deepest parts known. A depth of nearly 31,000 feet has been found in the South Pacific, near the Fiji Islands. See Davis' "Physical Geography," page 62, which we will send for $1.35 postpaid. 4. Can you refer me to any one of your special numbers pertaining to sounding, etc.? How it is done, and so on? A. You will find valuable articles upon the sounding of the ocean in our SUPPLEMENT, Nos. 1228, 1312, 1755, also many articles under the headings of Geology and Physical Geography in the Catalogue of Valuable Articles, of which we send you a copy. 5. I would like to have you give full description of Tester's new rotary disk turbine propelled by either steam, air or water. A. You will find a description of Tester's rotary disk turbine in the SCIENTIFIC AMERICAN, Vol. 105, No. 14; price, 10 cents mailed.

(12593) F. A. S. asks: Having a special interest in gyroscopes, I would ask you to please inform me as to whether they weigh the same spinning as when motionless. Would thank you also if you could refer me to some literature covering this particular phase of the phenomenon, that is, its weight while spinning and while stationary. A. There is no reason to suppose that a gyroscope weighs any less when in motion than at rest. Gravity acts independently of the motion of the body. The gyroscope rests upon its support with all its weight when it is spinning. If not supported, it would fall to the earth. We recommend and can supply Crabtree's "Spinning Tops and Gyroscopic Action," price $1.50, which is the latest book upon the subject. It goes quite fully into the theory of the subject.

NEW BOOKS, ETC.

A GUIDE TO GREAT CITIES: WESTERN EUROPE. By Esther Singleton. New York: The Baker & Taylor Company, 1911. 12mo.; 295 pp.; 16 illustrations. Price, $1.25 net.

Behind the crumbling stones of Old World cities lurks a soul which the hurried and worried tourist seldom more than glimpses. Yet only in the light of the past can we properly interpret the present. It is toward such an adequate and satisfying interpretation that Miss Singleton gently leads the willing traveler. Sixteen of the most famous cities of France, Spain, and Portugal are presented in pictures and in historical and descriptive narration, and although the style is of necessity condensed, the selection of material shows good judgment, a sense of proportion and, in the manner of its conveyance to the reader, somewhat more of charm than the dry tabulations of the average guide book.

NORTH WALSHAM AND THE NORFOLK BROADS. By Florence Bohun. YELVERTON (South Devon). By Edward Francis. New York: Frederick Warne & Co., 1911.

These are two newly-issued "Homeland" guide-books, abounding in fine illustration and graphic description and maintaining in every way the high standard which the publishers have set themselves. Cheap in price and

ephemeral as to concrete make-up, the little booklets may be tucked away in a pocket without compunction, yet are ever ready to yield up their exact knowledge and inspiring information for the benefit of traveler or shut-in. History, topography, and present-day features of interest are alike charmingly unfolded.

THE DREADNAUGHT BOYS ON BATTLE PRACTICE. By Captain Wilbur Lawton. New York: Hurst & Co., 1911. 12mo.; 305 pp.; illustrated. Price, 50 cents.

Life aboard a modern battleship, even in "the piping times of peace," has in it suggestion enough of excitement to fire the patriotism and set the blood simmering. When traitors enlist, and a foreign government attempts to learn through them the secret of a new explosive, it is evident that our two boy heroes, Ned and Herc, have their work cut out in the circumventing of their country's foes. The features of the modern American war vessel are sketched with a convincing pen, and the routine of sea life, the working of the big guns, and the incidents of target practice form the background for a series of thrilling adventures culminating in a "flare-back" that imperils many lives during the trial of the Varian gun and its marvelous new explosive.

LES PROGRES RECENTS DE L'ASTRONOMIE. (III. Année 1909.) La Comète de Halley á son retour de 1910, Par Paul Stroobant. Brussels: Hayez, Imprimeur de l'Observatoire Royal de Belgique, 1911. 174 pp.

Dr. Stroobant's annual monographs on the results of recent astronomical research are models of compact writing. On the whole, they present everything of importance that has been achieved in astronomy within the two years preceding their publication. They may therefore be regarded as running commentaries on the important astronomical events of our time. The present monograph is devoted very largely to a resumé of the studies made of Halley's comet on its return in 1910. Here will be found in 60 pages a complete history of the more important work done throughout the world on Halley's comet. Other topics discussed in the book are the sun and solar physics, the great planets and their satellites, variable stars, catalogues and charts, star colors, and the absorption and dispersion of light in space.

HUTTE. Des Ingenieur's Taschenbuch. (The Engineer's Pocket-Book.) Published by the Akademischer Verein Hütte. Berlin: W. Ernst & Sohn, 1911. Twenty-first edition. Three volumes. 1138, 1043, and 1185 pp. Copiously illustrated. Price, volumes 1 and 2, cloth, 13 marks; leather, 15 marks. Volumes 1, 2, and 3, cloth, 18 marks; leather, 21 marks.

This most excellent engineer's pocket manual requires no introduction or recommendation, as it is one of the most high class standard works of its kind. It will suffice in reviewing the book, to briefly indicate the principal additions and modifications which have been made in bringing the new edition up to date, a task which has been most thoroughly and successfully accomplished, as will be seen from the following extract from the preface. Among the entirely new sections added are the following: Mechanics of gases; automobile construction; illumination; foundations; building machinery; municipal construction and water power plant construction. A large number of sub-sections have also been newly introduced, of which the following will command special interest: Vector analysis and Fourier's series; spinning motion (gyroscopic motion); fuels and theory combustion; welding processes; ships' turbines and electrical conveyors. Much of the text has also been fundamentally revised to bring it up to date. This is particularly true of the chapters on statics of building construction; ventilation and heating; road building; the dynamics of solid bodies; water turbines, etc. In the section of electro-dynamics, much matter and illustration has been added, especially in the treatment of transformers and generators. The section on metallurgy of iron has been eliminated, as a special volume has recently been issued dealing with this subject alone. Information on the subject of iron, however, is found under the subject of chemistry (Stoffkunde). A third volume is issued under the title "Hütte des Bauingenieurs" (Building Engineers' Pocket Book). The first two volumes may be bought separately from the third.

HERSELF. Talks With Women Concerning Themselves. By E. W. Lowry, M.D. Chicago: Forbes & Co., 1911. 8vo.; 221 pp. Illustrated. Price, $1.

In "Herself," Dr. Lowry has again put out a popular work on sexual physiology and hygiene, this time addressed to the mature woman. Many prevalent false ideas are corrected; health, beauty, and happiness are shown to be the handmaids of cleanliness and morality. A warning is sounded against seeking the advice of advertising medical houses and quacks, and their methods are briefly exposed and branded. The author relies upon the very simplicity and frankness of her statements to hammer home the truths in a way that shall make immorality repugnant and pure ideals to be earnestly desired. Some such book as this should be the treasured possession of every woman, and we know of no other that more concisely marshals the facts or whose advice has in it more of the lucidity of common sense.

Hartford Fire Insurance Company

HARTFORD, CONN.

Incorporated, 1810 — Charter perpetual

No. 253 $3200

By this Policy of Insurance,

THE HARTFORD FIRE INSURANCE COMPANY,

In consideration of Twenty Four ⅝ Dollars to them paid by the Assured hereinafter named, the receipt whereof is hereby acknowledged,

DO INSURE,

Abraham Lincoln, of Springfield Illinois

AGAINST LOSS OR DAMAGE BY FIRE TO THE AMOUNT OF

Three Thousand ⅝ Two Hundred Dollars

3000 $ On his frame Two Sto… being 20 by 39 feet. Rea… 7 by 24 feet. Front Pa… Metal

75 $ On his frame Carriage H…

125 $ On his frame wood Hou… House and 7 feet East of… Lot 7. and Lot 8. Block…

For a more particular … and Survey No. 253. in … Policy and a Guaranty o…

3200 $ @ .3/4 $24.00

And the Hartford Fire Insurance Co… unto the said Assured, His Executors, Administrators and Assigns, … as above specified, from the Eighth day of … Eighth day of February one thous… the true and actual cash value of the property, at the time the same shall happen; and to … annexed to this Policy. PROVIDED ALWAYS, AND IT IS HEREBY DECLARED, th… insurrection, riot, or civil commotion, or of any military or usurped power, or any loss by th… on the property hereby insured, and not notified to this Company and mentioned in or endo… make any other insurance on the same property, and shall not with all reasonable diligence, … Policy shall cease and be of no further effect. And if any subsequent insurance shall be m… Insurance Company, amount to an over Insurance, said Company reserve to themselves … the property hereby Insured, whether prior or subsequent to the date of this Policy, the Assur… than the amount hereby Insured shall bear to the whole amount Insured on the said property; … premises shall at any time after the making, and during the continuance of this Insurance, be … *hazardous* or *extra-hazardous*, or specified in the memorandum of special hazards in the … also, in the terms and conditions aforesaid denominated *hazardous* or *extra-hazardous* … pany, in writing, and added to or endorsed upon this Policy, then, and from thenceforth, so l… MOREOVER DECLARED, that this Insurance is not intended to apply to, or cover any loss … money or bullion. And that this Policy is made and accepted, in reference to the condition… ed herein otherwise specially provided for.

This Policy shall not be valid until countersigned by the duly authorized Ag…

In witness whereof, The Hartford Fire Insurance Company … Attested

David Allyn Secretary. S. Huntington President.

Countersigned at Springfield this 8th day of February 1861

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THIS is a reproduction of a fire insurance policy issued by the Hartford Fire Insurance Company in 1861 on the home of Abraham Lincoln just before he left Springfield, Ill. for his first inauguration as President of the United States.

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